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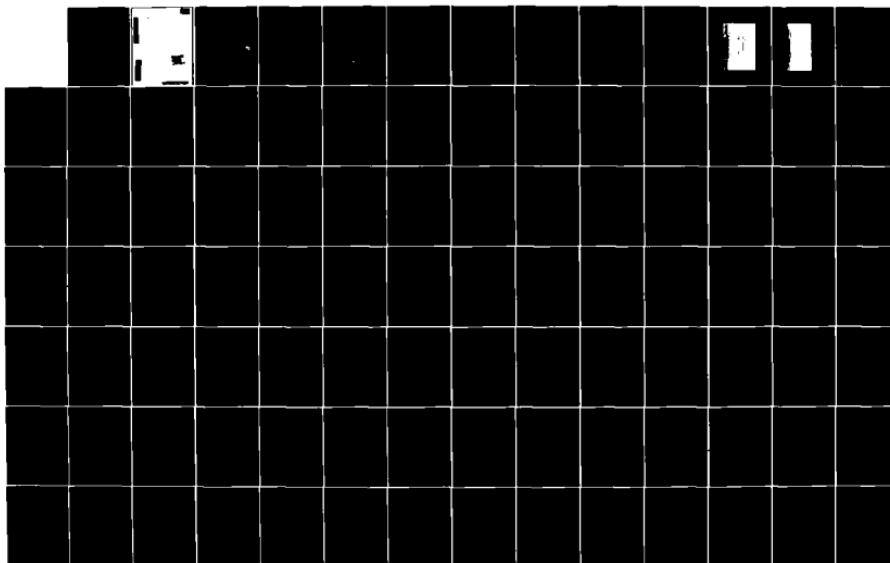
THE SOLAR SPECTRUM 3069A-2005A FROM THE ECHELLE  
SPECTROGRAPH FLOWN IN 1981. (U) NAVAL RESEARCH LAB  
WASHINGTON DC C. E. MOORE ET AL. 30 DEC 82 NRL-8653

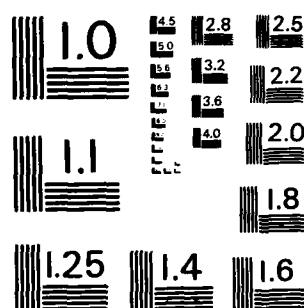
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20. ABSTRACT (Continued)

study of the multiplets in individual spectra and are based on a search of the spectroscopic literature. Laboratory wavelengths, multiplet numbers, and references are cited for each line. Approximately 6150 lines are reported, of which 80% are identified.

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# The Solar Spectrum 3069Å-2095Å

**From the Echelle Spectrograph  
Flown in 1961 and 1964**

**An Extension  
of  
Rowland's Preliminary Table  
of  
Solar Spectrum Wavelengths**

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June 1982**

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## PART I

### INTRODUCTION

#### Historical Background

The first solar spectrum in the ultraviolet range that is inaccessible from the ground was obtained on October 10, 1946 by the Naval Research Laboratory (NRL) (Baum et al. 1946). Although the resolution was only  $3\text{\AA}$ , this was sufficient to reveal many great absorption features: Si I 2882 $\text{\AA}$ ; Mg I 2852 $\text{\AA}$ ; Mg II 2803 $\text{\AA}$  and 2796 $\text{\AA}$ , the analogs of the H and K lines of Ca II; and numerous strong multiplets of Fe I and Fe II. During the next fifteen years there followed many observations of the solar spectrum from rockets, making use of far more powerful equipment. Within the range 3000 $\text{\AA}$  to 2100 $\text{\AA}$ , where the spectrum is almost exclusively one of Fraunhofer lines, an increase in spectral resolution by about one order of magnitude was achieved. Spectra having 0.5 $\text{\AA}$  resolution were obtained by both the Naval Research Laboratory and the University of Colorado. In the U.S.S.R. during 1956 and 1960 a group from the Institute of Optics in Leningrad flew a 1-meter grating spectrograph equipped with a solar pointing control (Jakovleva and Vedeshin 1978). With this instrument, spectra having 0.3 $\text{\AA}$  resolution from 2937 $\text{\AA}$  to 2471 $\text{\AA}$  were obtained on May 31, 1956; and in 1959, by using the same instrument in second order, a resolution of 0.15 $\text{\AA}$  was secured in the range 3100 $\text{\AA}$  to 2700 $\text{\AA}$ .

For the period through 1962, solar ultraviolet research from rockets has been described in detail by Tousey (1963). From these early flights came a series of publications best described as ultraviolet extensions of Rowland's Preliminary Table of Solar Spectrum Wavelengths (1895 to 1897) and of the Revision of Rowland's Preliminary Table by St. John et al. (1928). Mainly of historical importance are the first ultraviolet solar line lists of NRL (Durand, Oberly and Tousey 1949) and of the Applied Physics Laboratory of The Johns Hopkins University (Hopfield and Clearman 1948). The principal lists are the following: the spectra of NRL, from 2990 $\text{\AA}$  to 2635 $\text{\AA}$  by Wilson et al. (1954), and from 2635 $\text{\AA}$  to 2085 $\text{\AA}$  by Malitson et al. (1960); the spectra of the University of Colorado from 2965 $\text{\AA}$  to 1800 $\text{\AA}$  (Behring et al. 1958, McAllister 1960); and the spectra of the U.S.S.R. from 3100 $\text{\AA}$  to 2635 $\text{\AA}$  by Kachalov and Jakovleva (1962), and from 2635 $\text{\AA}$  to 2471 $\text{\AA}$  as a line list by Kachalov et al. (1958). Each of these publications except the last took the form of an atlas with the curve of spectral distribution plotted on a scale of absolute energy. The spectral resolution was in the range 0.15 $\text{\AA}$  to 1 $\text{\AA}$ . In the publications of NRL and of the University of

Colorado, the identifications of the lines were entered on the actual atlas curves. The identifications of the U.S.S.R. investigators were presented in the form of lists.

From the results of this first decade, it was already clear that an increase in spectral resolution by another order of magnitude would be necessary to resolve adequately the Fraunhofer lines in the ultraviolet solar spectrum. To achieve this required a spectrograph of small size and weight, yet capable of high spectral resolution. The timely development of the echelle diffraction grating by Harrison (1949), and of replication techniques by Bausch & Lomb, Inc. (Loewen 1972) under the direction of David Richardson, came at just the right time to make this possible.

In this report we present in final form a listing of the Fraunhofer lines as recorded by the NRL echelle spectrograph on the flights of 1961 and 1964. All plausible identifications have been made. In spite of much study many lines could not be identified, and so they will remain, awaiting further research in the laboratory.

For the first thirty years of space research, it was only the sun whose ultraviolet spectrum could be recorded with resolution sufficient to resolve satisfactorily the Fraunhofer lines. With the successful placing in orbit of an echelle spectrograph designed to study the stars (IUE 1978), there is available now a wealth of ultraviolet spectra of nonsolar objects. For the interpretation of these remarkable new spectra, this solar ledger will be of value.

#### The Echelle Spectrograph

Design of the NRL echelle spectrograph was commenced in 1952 by R. Tousey and F. S. Johnson. The instrument was completed by J. D. Purcell and flown on September 17, 1957. The peak altitude reached did not place the spectrograph above the entire ozone layer. Nevertheless the solar spectrum was photographed to 2600 $\text{\AA}$  with a resolution of 0.1 $\text{\AA}$ , and the potential of the instrument was proved (Purcell, Boggess and Tousey 1958).

The second flight, August 29, 1961, was a complete success. The spectrum was recorded to 2200 $\text{\AA}$  with a resolution of 0.03 $\text{\AA}$ , which was the best that was expected. In a third flight on November 21, 1964 the spectrum reached almost 2085 $\text{\AA}$ , the end of the range typical of the photosphere; the resolution was 0.05 $\text{\AA}$ . The instrument and the spectra have been described in detail by Tousey, Purcell and Garrett (1967).

In order that the spectrograph be as compact as possible, it was constructed in the Littrow form with the echelle grating taking the place of the Littrow mirror. The echelle was of 73.25 grooves per mm, 2:1 ratio of groove width to groove height, and  $63^\circ 26'$  blaze angle. The lens that provided both collimation and focusing was a triplet of 400 mm focal length with outer elements of lithium fluoride and central element of crystal quartz. Although the system was achromatized as completely as possible, there was a great deal of residual longitudinal chromatic aberration, which was corrected by pulling the film against a template of the proper shape. Separation of the many high-order spectra from the echelle was accomplished by cross-dispersion produced by a prism of calcium fluoride introduced between the lens and the echelle.

Because the intensity of the solar spectrum at  $\lambda > 4000\text{\AA}$  is great by comparison with the rapidly decreasing intensity shortward of  $3000\text{\AA}$ , it was necessary to minimize the radiation scattered by the echelle and the associated optical system. This was accomplished by means of a small, zero-dispersion double-monochromator constructed with Féry prisms of quartz. This predisperser was placed directly before the slit. The entire instrument was kept pointed at the sun with a solar pointing control that corrected for the yaw and pitch of the rocket.

Although the predisperser was adjusted to reject the entire solar spectrum at  $\lambda > 3300\text{\AA}$ , the residual scattered light was not negligible and set a limit on the shortest wavelengths that could be photographed. On the 1961 flight the spectrum reached  $2200\text{\AA}$  before it became swamped with stray light. For the 1964 flight the predisperser was readjusted to reject all radiation of  $\lambda > 2500\text{\AA}$ . As a result, the stray light was reduced and the spectrum extended nearly to  $2085\text{\AA}$ .

A second effect of the scattered light was to fill in somewhat the bottoms of the strongest Fraunhofer lines. Contributing to this was another type of stray light produced by ghosts present in the echelle images. To evaluate this "nearby" stray light, the spectrum of a source containing narrow emission lines was photographed in the laboratory. The profile of Fe II 2739.545 $\text{\AA}$  from line-center to 10% of peak was found to be approximately Gaussian with a full width at half maximum (FWHM) of  $0.03\text{\AA}$ . Farther from line-center it broadened faster than Gaussian and beyond  $0.1\text{\AA}$  from line center the intensity remained at about 1% of peak. It is difficult to evaluate precisely the magnitude of these effects. Although the stray light increased in intensity with decreasing wavelength, the increase was not sufficiently rapid to affect relative intensities within multiplets. It is not certain that any faint lines were obliterated by scattered light except at the short-wavelength end of the spectrum.

The optical characteristics of the system were such that radiation was accepted from the sun's center to about  $1/3 R$ . Therefore, the echelle spectra should be regarded as disc spectra with no significant contribution from regions near the limb.

### The Echelle Spectra

The solar spectrum photographed by the echelle spectrograph on the flight of 1961 is reproduced in Fig. 1. In actual size the frame measured  $25\text{mm} \times 25\text{mm}$ . To record photographically the entire spectral range required exposures of several different times, and Fig. 1 is a composite. The dispersion on the film runs linearly with order number, shown at the left, from  $2.5\text{\AA/mm}$  near  $4000\text{\AA}$  to  $1.25\text{\AA/mm}$  at  $2000\text{\AA}$ . For wavelengths greater than  $3069\text{\AA}$  the spectrum was not studied because this region is well known from the ground-based observations (Moore, Minnaert, Houtgast 1966).

For the shortest wavelengths the most useful spectra were obtained from the flight of 1964, as shown in Fig. 2. Although the spectra extend to  $2085\text{\AA}$ , approximately, the lines reported here are limited to  $\lambda > 2095\text{\AA}$ . Below  $2085\text{\AA}$  the continuum intensity falls by a factor of 4 or 5 within  $15\text{\AA}$ . Therefore, shortward of  $2085\text{\AA}$  the Fraunhofer lines are almost vanishingly faint and little of value was present in the spectra below  $2095\text{\AA}$ .

The spectral resolution in the 1961 spectra was  $0.03\text{\AA}$ . This was consistent with the  $0.03\text{\AA}$  FWHM of Fe II 2739.545 $\text{\AA}$ , determined in the laboratory before flight. In the 1964 spectra the resolution was  $0.05\text{\AA}$ , owing to a slight deterioration of adjustment during flight. Twelve exposures were made during each flight, of times between 2 s and nearly 100 s.

### The Preliminary Solar Ledger

Analysis of the echelle spectra was commenced soon after the 1961 flight. The first task was to establish a wavelength scale. This could not be done with sufficient precision simply by using the grating equation because of the great distortion introduced by the several refractive elements in the optical system. It was necessary also to establish a separate wavelength scale for each order. This was done empirically by comparison with exposures made with a low-pressure, RF-excited iron arc which produced a rich, narrow-line spectrum of Fe I and Fe II. The iron lines were used as internal standards for the generation of the dispersion curve for each order. The dispersion equation was set up as a third order polynomial with coefficients adjusted by computer until the residuals were minimal and random. With the aid of these dispersion equations the wavelengths of the solar lines were derived for each order from their measured positions.

The first solar ledger was prepared from the 1961 spectra by L. E. Giddings. The list extended from  $3069\text{\AA}$  in order 80 to  $2288\text{\AA}$  in order 106. By making use of the 1964 spectra, the list was carried to  $2095\text{\AA}$  in order 116. The complete list contained 7146 lines. The lines in this preliminary ledger were identified as to chemical origin by P. A. Simmons. The identifications

were based mostly on the Multiplet Tables (UV and MT in the references). Identifications were proposed for about half of the observed solar lines. Although considered preliminary, copies of the ledger were distributed on request.

#### **The NRL Solar Atlas: 2226Å to 2992Å**

The preparation of an atlas that would contain curves of spectral irradiance at one AU in absolute units of energy and at full spectral resolution was commenced soon after the 1961 flight. The best spectra were scanned with a microphotometer and the values of density were converted to relative intensities by means of photographic characteristic curves. Finally, the relative values of intensity were converted to absolute values of irradiance in  $\mu\text{Wcm}^{-2}\text{\AA}^{-1}$ . This was done by adjustment of the relative

intensity curves to the curves of absolute intensity at 2.5Å spectral resolution of Wilson et al. (1954) and Malitson et al. (1960). The adjustment was carried out at 142 wavelength positions scattered over the entire range. The curves of lower resolution had been calibrated by comparison with data from an instrument designed primarily for the measurement of the absolute spectral solar flux. This procedure was complex and is described in detail in the NRL Atlas (Tousey et al. 1974).

The wavelength scale for the Atlas was derived from the Preliminary Ledger, which was nearing completion well before the Atlas was completed. The short-wavelength end of the Atlas coincided with the end of the echelle spectrum of 1961. The long-wavelength end was set somewhat arbitrarily by the end of order number 80, and because the Atlas being produced from observations at the Jungfraujoch Observatory was expected to extend to 3000Å (Delbouille, Neven and Roland 1963, 1973).

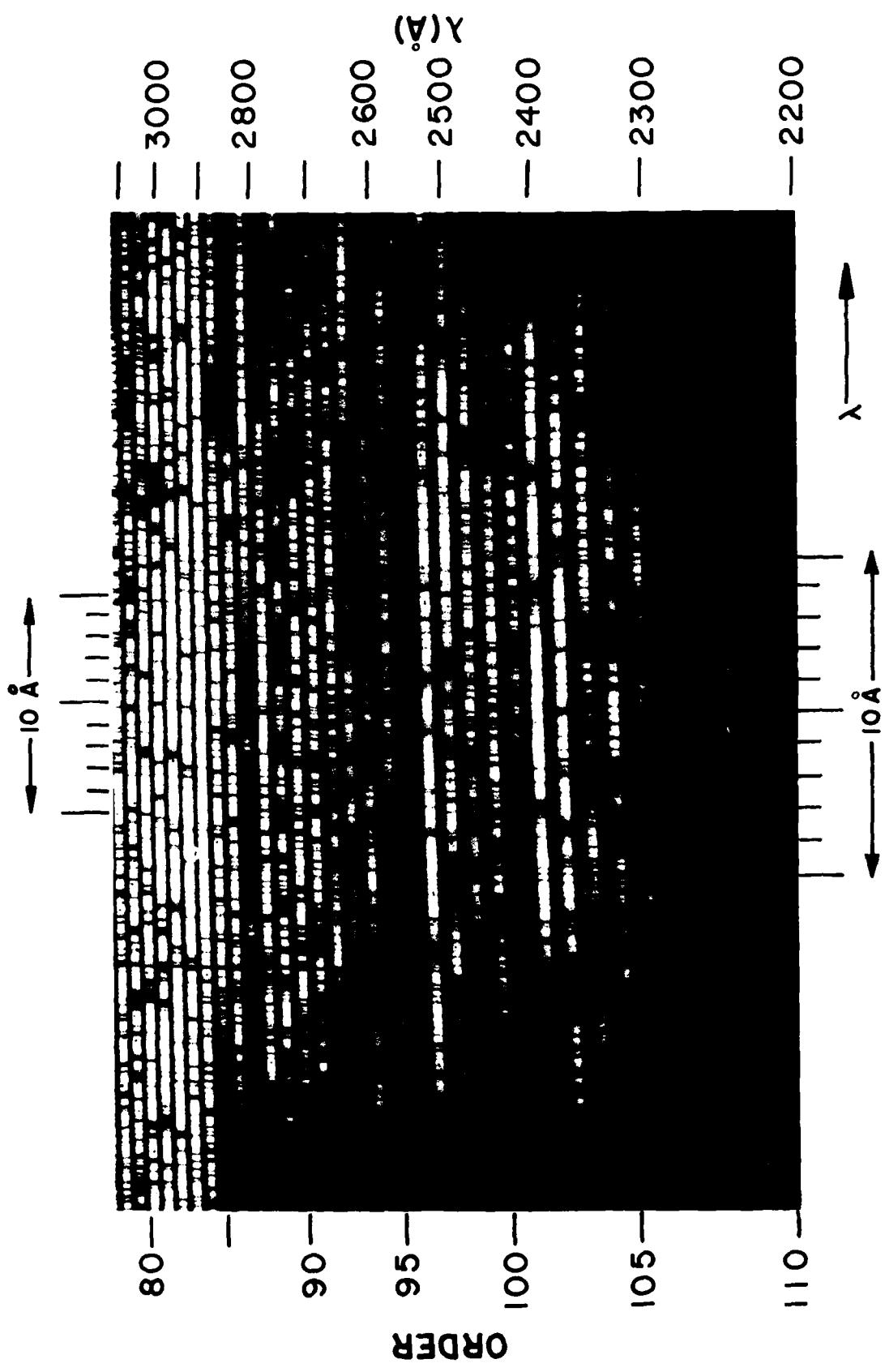


Fig. 1 — The Ultraviolet Solar Spectrum recorded on August 29, 1961 with the NRI Echelle Spectrograph

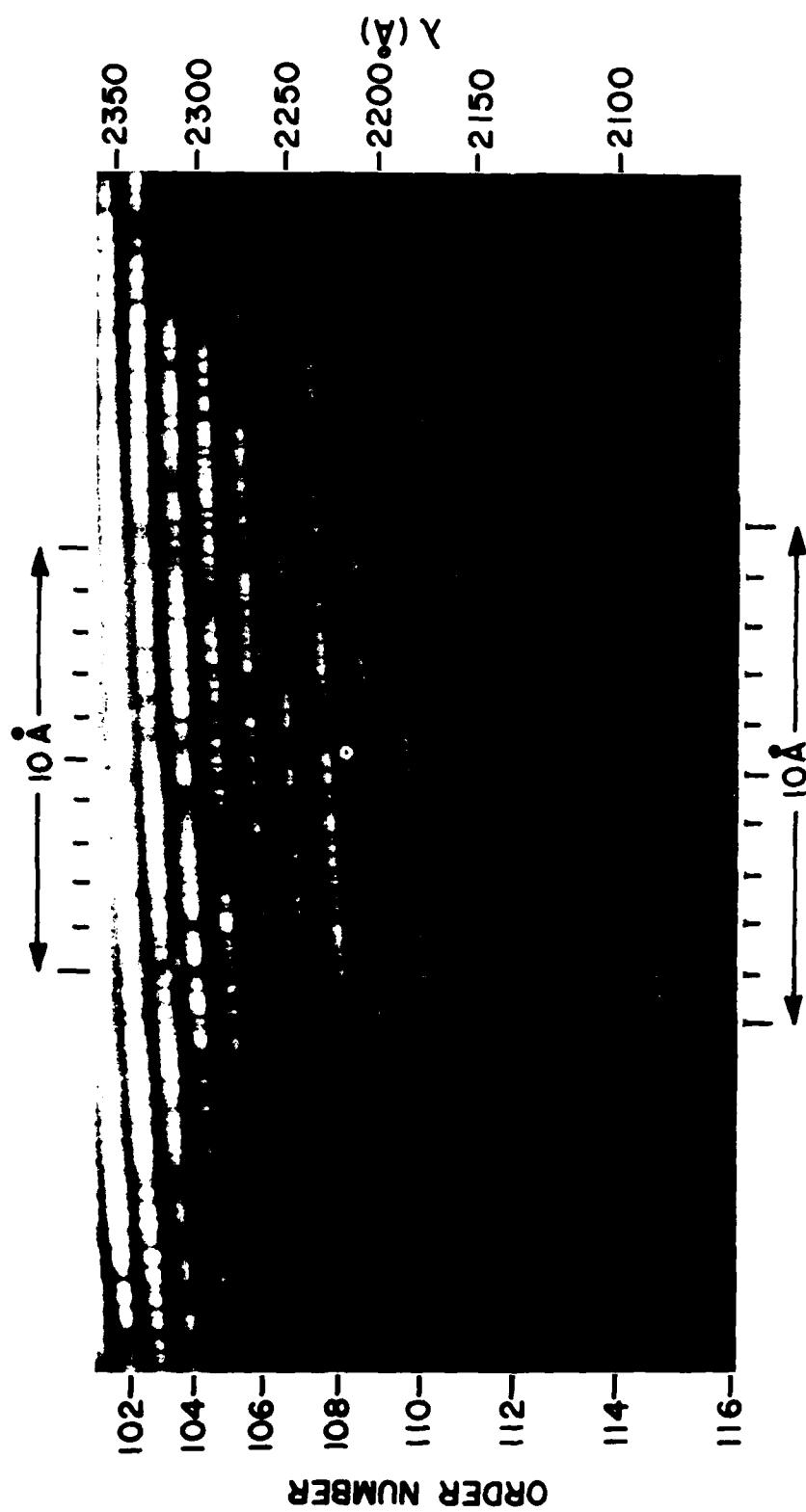


Fig. 2 — The shortest wavelengths in the solar spectrum recorded on November 12, 1964 with the N.R.I. Echelle Spectrograph

## PART II

### THE FINAL SOLAR LEDGER

#### Procedure

In preparing the Final Solar Ledger the Preliminary Ledger has been extensively revised. The wavelength and intensity of each solar line were reconsidered. New lines were added and doubtful lines were deleted. The identifications were restudied in detail, taking into account laboratory wavelengths published or available through mid-1981. The complete multiplet structure was examined for each multiplet believed to be present or expected. Lines of individual spectra were identified on the basis of the behaviour of their ultimate lines including those outside the NRL echelle range.

The reexamination of the spectra involved a study of the same set of prints that formed the basis for the preliminary list. One print was available for each order, taken from the exposure of most suitable density. These prints were enlarged to a dispersion of about 1 Ångstrom per inch; therefore, all lines could be studied easily without using a magnifier. Also taken into consideration was the Atlas, which was not available when the preliminary list was compiled. The Atlas often served to disentangle features that were not clearly interpretable from the prints.

The Final Solar Ledger is based on the NRL echelle spectra only. Other spectra obtained since 1964 are discussed in Part IV. The spectroscopic material used for identification includes the Multiplet Tables of Moore (1945-1981), supplemented by data published after completion of the various Multiplet Tables and by unpublished work available to mid-1981. Predicted wavelengths have been used where laboratory measurements are missing for members of multiplets expected to be present in the solar spectrum.

The preparation of the Final Solar Ledger from the Preliminary Ledger proceeded as follows. First, the identifications were examined in detail as described above, by element and ion from the lightest atom through the heaviest that might possibly be encountered. From all available material, the best laboratory wavelength was chosen for each line and a judgment was made of its value for use as an internal standard of wavelength. Then, by reexamining the prints, the reality of each line was verified and its wavelength was checked by interpolation between the various nearby lines that appeared to be suitable as standards. At the same time

visual intensities were reexamined and compared with the intensities expected from laboratory data, and also with the intensities in the Atlas. It was always necessary to consider blending and masking and to estimate the expected intensities of contributors by consideration of the intensities of related well-identified unblended lines.

The result of this iterative process is the Final Ledger that forms the main body of this publication. In character this final solar line list is conservative; many lines in the preliminary list have been omitted, a smaller number have been added.

#### The Solar Wavelengths

In column 1 of the Solar Ledger the wavelengths in air and in Ångstrom units are listed for all features present in the echelle spectra. All entries refer to ordinary, unblended lines of width consistent with the instrumental profile, 0.03 Å FWHM, unless accompanied by a brace. A brace in Column 1 indicates a pair or group of lines between the tabulated wavelength-limits that are not completely resolved but for which it was possible to assign separate wavelengths and intensities. A brace in the intensity column indicates that two or more lines are present but not well-resolved, and that a single intensity has been given to the entire feature.

The process of determining wavelengths was one of continual adjustment and fitting. Beginning at one end of an order, a print was examined and the identified lines were noted together with their laboratory wavelengths and intensities. Although the dispersion was not constant along an order, within intervals of one or two Ångstroms it was sufficiently constant to permit making a linear interpolation. For each short interval a linear scale was constructed, based on solar lines believed to be unblended and satisfactory for use as internal standards. Wavelengths of unidentified lines were read from these scales. Wavelengths of identified lines not used as internal standards were also checked. Inevitably, the wavelengths of some such lines were not in acceptable agreement with the laboratory values. In each such case a decision was made as to whether the line was incorrectly identified or whether it was a blend.

All solar wavelengths are given to two decimal places even though it has been stated in earlier publications that the accuracy is better than 0.01 Å. In general,

the probable error of each solar wavelength is considered to be about  $\pm 0.005\text{\AA}$ . In selected regions three-place entries may be justified for lines of good quality that show no effects of blending, provided that there are satisfactory lines nearby for use as standards. At the short-wavelength end the error is larger, and at  $2095\text{\AA}$  the Ledger was terminated.

### The Solar Intensities

The estimated intensities of the solar lines are given in column 2 on a scale that was strictly visual. The scale was arbitrary, from 1 for the faintest lines to 9 for the strongest. Features that were too broad to be single, narrow lines were indicated by the following symbols in Column 2, which are descriptive of the character of the line:

<i>D</i>	wide and double (unresolved pair)
<i>d</i>	double
<i>H</i>	very hazy
<i>h</i>	hazy
<i>W</i>	very wide
<i>w</i>	wide

Values of visual intensity were assigned to lines by studying the appearance of images on the large prints. A comparison was also made with the intensity tracings in the *Atlas*, taking particular note of the depths of the lines. In this way it was possible to set up a range of central intensity for each value of visual intensity. This process of comparison was particularly helpful for assigning meaningful visual intensities at the ends of orders where the contrast was less, and for making certain that the scale of visual intensities carried over from order to order.

Visual intensities have their greatest significance, of course, over short ranges of the spectrum, and lose meaning rapidly the greater the wavelength difference between the lines being compared. This is especially true of the echelle spectrum, whose character changes greatly as the short wavelength end is approached. Over the wavelength-range of most multiplets, however, the visual intensities assigned to the solar lines can be compared directly with the relative intensities reported for laboratory spectra.

Broad, strong lines with extended wings presented two difficulties when assigning visual intensities. The prime examples of such lines are Mg II  $2796\text{\AA}$  and  $2803\text{\AA}$ , each of which dominates the spectrum over some  $30\text{\AA}$ , and Mg I  $2852\text{\AA}$  which spans more than  $15\text{\AA}$ . To a lesser degree the same is true of the leading lines of Fe I, Fe II, Ni I, Mn II and Si I. The first difficulty was in the assignment of a visual intensity that would take into account both the central depth and the width for a very broad, intense line. Arbitrarily, intensities 8 and 9 were restricted to lines that are wide as well as deep. For the

Mg lines noted above, however, a meaningful assignment of intensity could not be made.

The second difficulty related to the obscuring effect of a very wide line on other lines that lie within the span of its wings. Rather than base the visual intensity strictly on conspicuously for a line lying within a broad wing, an allowance was made for the effect of the wing on its apparent strength. This was an imprecise procedure at best, and it is probable that the intensities were underestimated for lines lying in the deepest parts of strong, wide lines.

A list of lines judged to be "winged" is presented in Table 1. They were selected by examining systematically their profiles as shown in the *Atlas*. The criterion for inclusion was appearance, independent of origin or multiplet structure. Columns 1 to 4, wavelength, intensity, identification, and multiplet number, were taken from the Ledger. The fifth column lists the low excitation potential as given in the multiplet tables. The last column gives the effective span of the wings in  $\lambda$ , and  $\Delta\lambda$ . This span, estimated arbitrarily to an accuracy of about  $0.1\text{\AA}$ , although far from well-defined, serves as a guide to the possible masking effect of the wings. Of the 90 winged lines listed in Table 1, 76 are single lines, 12 are blends of two lines, and 2 are blends of three lines, for a total of 106 lines. Most of these lines are of intensity 6 or greater and in the Ledger are described as "W", as would be expected.

### The Identification of the Solar Lines

The spectra identified as accounting for the observed solar lines are entered in the Final Solar Ledger as columns 3 to 6: atomic or ionic spectrum; multiplet number; laboratory wavelength, accompanied by the symbol  $\pm$  in the case of a raike ultime; and reference, respectively. Two molecular spectra are included: OH, known to be present and strong at longer wavelengths; and SiO, which is identified here for the first time. Where the solar feature is produced by more than one line the contributors are entered in order of increasing wavelength.

The symbols in column 3 have the following meanings:

- following the identification denotes that the laboratory line is to the violet of the solar line, and vice versa for the dash preceding.
- || preceding the identification indicates a predominant contributor, which almost but not completely masks all other contributors.
- | preceding the identification denotes a principal contributor which is only moderately the strongest contributor to a blend.

Table I — Winged Lines in the Echelle Solar Spectrum

Solar Wavelength Å	Intensity	Identification	Multiplet No.	Low E P	Span of Wings Å	
					λ	Δλ
2310.96	8W	N II	10	0.00	2310.6 - 2311.3	0.7
2312.34	7W	N II	10	0.16	2312.2 - 2312.5	0.3
2317.16	7W	N II	8	0.16	2317.0 - 2317.3	0.3
2320.04*	8W	N II	9	0.00	2319.8 - 2320.2	0.4
2325.80	7W	N II	9	0.16	2325.7 - 2326.0	0.3
2327.41	7W	Fe II	3	0.08	2327.1 - 2327.7	0.6
2329.96	7W	N II	8	0.27	2329.8 - 2330.1	0.3
2331.30	7W	Fe II	35	0.23	2331.1 - 2331.6	0.5
2332.82	9W	Fe II	3	0.05	2332.3 - 2333.3	1.0
2338.00	9W	Fe II	3	0.11	2337.0 - 2339.0	2.0
2343.50	9W	Fe II	3	0.00	2342.5 - 2344.5	2.0
2348.13	7W	Fe II	36	0.23	2347.8 - 2348.5	0.7
2348.31	8W	Fe II	3	0.08		
2354.88	6W	Fe II	35	0.35	2354.8 - 2355.1	0.3
2359.10	8W	Fe II	3	0.11	2358.8 - 2360.6	1.8
2360.01	7W	Fe II	35	0.23		
2360.29	7W	Fe II	36	0.30	2364.4 - 2365.2	0.8
2364.84	8W	Fe II	3	0.05		
2368.60	7W	Fe II	36	0.35	2368.3 - 2368.9	0.6
2373.75	8W	Fe II	2	0.00	2373.4 - 2374.0	0.6
2375.20*	7W	Fe II	36	0.38	2375.0 - 2375.4	0.4
2379.28	7W	Fe II	36	0.30	2379.1 - 2379.5	0.4
2380.76	8W	Fe II	3	0.08	2380.6 - 2381.1	0.5
2382.03	9W	Fe II	2	0.00	2381.2 - 2384.0	2.8
2388.65	8W	Fe II	2	0.05	2388.1 - 2389.2	1.1
2395.62	9W	Fe II	2	0.05	2394.5 - 2396.5	2.0
2399.25*	8W	Fe II	2	0.08	2398.9 - 2399.6	0.7
2404.93	9W	Fe II	2	0.08	2404.0 - 2405.5	1.5
2406.66	8W	Fe II	2	0.11	2406.4 - 2406.9	0.5
2410.55	8W	Fe II	2	0.11	2410.2 - 2411.4	1.2
2411.08	8W	Fe II	2	0.12		
2413.31	8W	Fe II	2	0.12	2413.0 - 2413.6	0.6
2435.15	7W	Si I	45	0.78	2434.9 - 2435.5	0.6
2462.65	8W	Fe I	9	0.00	2462.5 - 2462.8	0.3
2472.91*	8W	Fe I	9	0.05	2472.7 - 2473.1	0.4
2479.77	7W	Fe I	9	0.09	2479.5 - 2480.1	0.6
2483.28	8W	Fe I	9	0.00	2482.9 - 2483.7	0.8
2488.14	8W	Fe I	9	0.05	2487.7 - 2488.5	0.8
2490.65	7W	Fe I	9	0.09	2490.4 - 2491.5	1.1
2491.15	6W	Fe I	9	0.11		
2501.13	7W	Fe I	7	0.00	2500.8 - 2501.5	0.7
2506.91	8W	Si I	1	0.01	2506.7 - 2507.1	0.4
2510.84	7W	Fe I	7	0.05	2510.6 - 2511.1	0.5
2514.31	8W	Si I	1	0.00	2514.2 - 2514.6	0.4
2516.10	9W	Si I	1	0.03	2515.6 - 2516.6	1.0
2519.20	8W	Si I	1	0.01	2519.0 - 2519.3	0.3
2522.85	8W	Fe I	7	0.00	2522.6 - 2523.0	0.4
2524.11	7W	Si I	1	0.01	2523.8 - 2524.4	0.6
2524.28	6W	Fe I	7	0.11		
2527.43	7W	Fe I	7	0.05	2527.2 - 2527.6	0.4
2528.51	7W	Si I	1	0.03	2528.3 - 2528.7	0.4
2540.97	6W	Fe I	7	0.11	2540.6 - 2541.4	0.8
2545.97	6W	Fe I	7	0.09	2545.7 - 2546.4	0.7

Table 1 — Winged Lines in the Echelle Solar Spectrum — Continued

Solar Wavelength Å	Intensity	Identification	Multiplet No.	Low E P	Span of Wings Å	
					λ	Δλ
2549.61	6W	Fe I	7	0.05	2549.4 - 2549.8	0.4
2562.54	7W	Fe II	64	0.98	2562.2 - 2562.8	0.6
2563.49	6W	Fe II	64	1.04	2563.2 - 2563.7	0.5
2566.91	6W	Fe II	64	1.07	2566.7 - 2567.1	0.4
2576.12	8W	Mn II	1	0.00	2575.7 - 2576.5	0.8
2577.91*	7W	Fe II	64	1.09	2577.8 - 2578.1	0.3
2582.58	6W	Fe II	64	1.07	2582.3 - 2582.9	0.6
2585.90*	9W	Fe II	1	0.00	2584.8 - 2587.0	2.2
2593.72*	7W	Mn II	1	0.00	2593.1 - 2594.3	1.2
2598.37	9W	Fe II	1	0.05	2596.9 - 2601.9	5.0
2599.40	9W	Fe II	1	0.00		
2605.67*	6W	Mn II	1	0.00		
2607.09	9W	Fe II	1	0.08	2605.4 - 2605.9	0.5
2611.89	9W	Fe II	1	0.05	2606.3 - 2607.9	1.6
2613.85	8W	Fe II	1	0.11	2611.2 - 2612.6	1.4
2617.63	8W	Fe II	1	0.08	2613.2 - 2614.4	1.2
2621.68	8W	Fe II	1	0.12	2616.9 - 2618.3	1.4
2625.68	8W	Fe II	1	0.05	2621.3 - 2622.1	0.8
2628.30	8W	Fe II	1	0.12	2624.9 - 2626.3	1.4
2631.04	8W	Fe II	1	0.11	2627.8 - 2628.8	1.0
2631.33	8W	Fe II	1	0.08		
2714.42	7W	Fe II	63	0.98		
2719.04	8W	Fe I	5	0.00	2630.2 - 2632.1	1.9
2720.90	7W	Fe I	5	0.05		
2723.58	6W	Fe I	5	0.09		
2727.55	7W	Fe II	63	1.04	2723.3 - 2723.9	0.6
2736.97	6W	Fe II	63	1.07	2727.2 - 2727.9	0.7
2737.30	6W	Fe I	5	0.11		
2739.56	8W	Fe II	63	0.98		
2742.40	6W	Fe I	5	0.09	2738.8 - 2740.4	1.6
2743.20	7W	Fe II	62	1.09	2742.1 - 2742.7	0.6
2746.49	7W	Fe II	62	1.07	2743.0 - 2743.4	0.4
2746.98	7W	Fe II	63	1.04		
2749.18	7W	Fe II	63	1.07		
2749.32	7W	Fe II	62	1.04	2745.8 - 2747.2	1.4
2749.48	6W	Fe II	63	1.09		
2755.74	8W	Fe II	62	0.98		
2779.84	7W	{Mg I	6	2.70	2755.3 - 2756.2	0.9
2788.11	7W		6	2.70		
2795.53	—	Mg II	1	0.00	2779.6 - 2780.1	0.5
2802.70	—	Mg II	1	0.00	2787.8 - 2788.4	0.6
2852.13	—	Mg I	1	0.00		
2881.58	8W	Si I	43	0.78		
2912.15	7W	Fe I	1	0.00	2880.3 - 2882.9	2.6
2936.51	7W	Mg II	1	0.00	2912.0 - 2912.3	0.3
2936.91	8W	Mg II	2	4.41	2936.3 - 2937.2	0.9
2947.89	8W	Fe I	1	0.00		
2953.93	8W	Fe I	1	0.05		
2966.91	9W	Fe I	1	0.09	2947.3 - 2948.3	1.0
2973.13	7W	Fe I	1	0.00	2953.5 - 2954.3	0.8
2973.23	8W	Fe I	1	0.05	2966.4 - 2967.4	1.0
2983.59	8W	Fe I	[9]	0.00	2972.8 - 2973.6	0.8
					2983.3 - 2983.9	0.6

\*Entered in Ledger as a blend, but in the study of the winged lines the predominant contributor was considered as unblended

For example,

2166.19	5D	Ni I—    Fe II
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2165.55	6d	Ni II Fe II
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The solar intensity to be expected, as judged by the intensities of other lines in a multiplet, has been the guiding factor in deciding the question of principal vs. predominant contributor.

Multiplet numbers (column 4) are taken from three sources:

The Ultraviolet Multiplet Table  
The Multiplet Table of Astrophysical Interest  
Selected Tables of Atomic Spectra

The Multiplet Tables are noted in column 6 as UV and MT, respectively. Multiplet numbers from the MT are bracketed throughout to distinguish them from those in the UV Tables.

The laboratory wavelengths used to identify the solar lines as to chemical origin are recorded in column 5. Many of these values are taken from the Multiplet Tables, but additional values have been quoted from revised and extended analyses, or from more homogeneous lists of wavelengths. Certain solar identifications have been based on predicted wavelengths in cases where expected members of multiplets have never been observed in the laboratory. In these cases the appropriate multiplet numbers are entered in column 4. No multiplet numbers have been added, however, for new multiplets that are known from revised analyses of various spectra. For cases of laboratory blends, where one line has more than one designation, both multiplet numbers are given in column 4 and the wavelength is repeated in column 5. For example,

2399.25	8W	Fe II	2	2399.237
		Fe II	36	2399.237

For molecular lines the chemical symbol is entered in column 3; in column 4, instead of a multiplet number the vibrational quantum numbers are given, enclosed in parentheses.

Reference numbers for the identification work are in the last column. This reference list follows the Ledger.

The first column in the reference list indicates the spectra for which each reference has been used.

#### Criteria for the Identifications

One criterion for reliable identifications is satisfactory agreement between solar and laboratory wavelengths. For prominent solar lines there was rarely any question when the wavelength agreement was good and the particular spectrum was known to be well represented in the solar ledger. Throughout the identification work, however, multiplet structure was considered in detail together with wavelength agreement. The general run of solar intensities within multiplets was an important guide and blended lines were often detected from intensity anomalies. Lines that were expected but missing had to be accounted for. Masking of lines falling within the wing-span of the strongest solar lines has required extensive detailed study throughout the work.

The degree of agreement expected between solar and laboratory wavelengths varies greatly depending on the width and general character of the solar line. In addition, the accuracy of laboratory wavelengths varies widely among different spectra. For a line that appeared to be unblended, a tolerance of  $\pm 0.03\text{\AA}$  (Sun - Lab) was taken as acceptable in most cases. For a few partially resolved blends, winged lines, or other complex features a greater tolerance was allowed.

The winged lines of Table 1 and many other strong lines often masked lines that should have been present on multiplet evidence. The decision whether to include a missing line in the ledger as a contributor to a blend, or omit it as masked was often difficult and always involved personal judgment.

A complete list of lines believed to be masked was prepared but is too long to include. A selected list of the more important masked lines is given in Table 2. The arrangement is by increasing atomic number, Z (column 1), followed by the spectrum (column 2), and by the laboratory wavelength, intensity, and multiplet number of the line believed to be masked, (columns 3, 4 and 5). The wavelength and visual intensity of the solar masking line are given in columns 6 and 7; the identification and multiplet number of the masking line are in the two columns that follow. The entries for the masking lines, (columns 6 to 9), are taken from the Solar Ledger. The last column, (Sun - Lab), gives the wavelength separation between the masking line and the missing line.

Table 2 — Selected Masked Lines

Z	Spectrum	Lab $\lambda$	Lab Int.	Mult No.	Solar $\lambda$	Solar Int.	Solar Ident.	Mult No.	$\Delta\lambda$ Solar - Lab
4	Be I	2650.550	5	2	2650.47	4	Be I— Fe II	2 410	-0.08
5	B I	2497.7233	10R	1	2497.71	6	Fe II	128	-0.01
		2496.7717	8R	1	2496.77	4	Fe II Fe	242 —	0.00
12	Mg I	2617.513	3	14	2617.63	8W	Fe II	1	+0.12
13	Al I	2311.035	4	12	2310.96	8W	Ni I	10	-0.08
		2312.491	5	12	2312.34	7W	Ni I	10	-0.15
		3059.029	4	[7]	3059.11	8W	Fe I	[9]	+0.08
		3064.290	7	[7]	3064.23	4	OH	(0-0)	-0.06
14	Si I	2631.282	190	83	2631.33	8W	Fe II	1	+0.05
20	Ca I	2150.796	2	8	2150.75	7W	Al I	—	-0.05
		3000.863	9	[17]	3000.93	8W	Cr II Fe II	37 248	+0.07
22	Ti I	2631.526	8	5	2631.61	7	Fe II	171	+0.08
		2384.516	7	12	2384.39	6W	Fe II	36	-0.13
		2380.818	5	13	2380.76	8W	Ni I	10	-0.06
		2279.964	6	15	2279.92	5W	Fe II	3	-0.04
		2965.240	5	27	2965.26	7	Fe I	4	+0.02
		3000.892	10	[29]	3000.93	8W	Fe I	16	+0.04
		2498.930	1	10	2498.89	7W	Fe I	1	-0.04
		2716.250	4	13	2716.23	6D	Fe II—	8	+0.03
23	Vd I	2719.39	2	13	2719.42	5	Fe I	161	-0.02
		2957.30	10?	1	2957.36	7W	Fe I	261	+0.01
		2656.224	60R	13	2656.14	5	Fe I	155	+0.03
		2545.981	30r?	15	2545.97	6W	Fe I	154	+0.02
		2506.902	150R	17	2506.91	8W	Si I	7	-0.01
		2503.300	50r	17	2503.33	5	Fe II	1	+0.01
		2501.608	60R	19	2501.69	6W	Fe I	206	+0.03
		2428.269	100R	23	2428.29	6	Fe II	56	+0.08
23	Vd II	2380.910	120	25	2380.76	8W	Fe II	301	+0.02
		2528.466	200	50	2528.51	7W	Si I	7	-0.15
		2983.558	80n	[28]	2983.59	8W	Fe I	[9]	+0.04
24	Cr I	2364.73	150r	1	2364.84	8W	Fe II	1	+0.05
		3000.88	50r	11	3000.93	8W	Fe I	[9]	+0.11
		2620.480	12	20	2620.41	7W	Fe II	1	-0.07

Table 2 — Selected Masked Lines — Continued

Z	Spectrum	Lab $\lambda$	Lab Int.	Mult No.	Solar $\lambda$	Solar Int.	Solar Ident.	Mult No.	$\Delta\lambda$ Solar - Lab
24	Cr I cont.	3020.671	50 <sub>r</sub>	[27]	3020.63	9W	Fe I	[9]	-0.04
		2491.35	20	31	2491.40	4W	Fe II	207	+0.05
		2506.82	25	31	2506.91	8W	Si I	1	+0.09
		2502.55	25 <sub>r</sub>	32	2502.50	4	Fe I	—	-0.05
		2157.74	30 <sub>b</sub>	44	2157.80	4	Fe I	24	+0.06
							Ni I	36	
		2739.395	20	63	2739.56	8W	Fe II	63	+0.16
		2697.01	15	65	2697.02	5	Fe I	100	+0.01
		2778.213	12	93	2778.25	7D	Fe I —	44	+0.04
							Mg I	6	
24	Cr II	2320.39	10	19	2320.34	6W	Fe I	14	-0.05
		2226.35	15	35	2226.31	7W	Ni II	12	-0.04
		2398.51	15	43	2398.56	5	Ca I	—	+0.05
		2419.87	15	43	2419.88	5	Fe I	68	+0.01
							Fe II	180	
		2723.64	60	59	2723.58	6W	Fe I	5	-0.06
		2630.93	50	63	2631.04	8W	Fe II	1	+0.11
							Fe II	171	
		2853.18	30	81	2852.13		Mg I	1	-1.05
		2563.58	50	89	2563.49	6W	Fe II	64	-0.09
		2588.25	12	89	2588.27	5	Mg I	—	+0.02
25	Mn I	2936.92	25	95	2936.91	8W	Fe I	1	-0.01
		2764.28	15	100	2764.33	6w	Fe I	128	+0.05
							Cr I	15	
		2755.53	15	101	2755.74	8W	Fe II	62	+0.21
		2755.81	10	101	2755.74	8W	Fe II	62	-0.07
		2723.48	30	102	2723.58	6W	Fe I	5	+0.10
		3047.62	20	[15]	3047.60	8W	Fe I	[9]	-0.02
							Al I	3	
		2372.116	10d	2	2372.08	5w	Al I	11	-0.04
		2097.554	30	—	2097.51	4W	Fe II	80	-0.04
25	Mn II	2928.678	40	17	2928.62	6	Mg II	2	-0.06
		2435.137	40	33	2435.15	7W	Si I	45	+0.01
							Fe II	120	
		2625.606	3000	19	2625.68	8W	Fe II	1	+0.07
		2719.012	300	33	2719.04	8W	Fe I —	5	+0.03
							Fe I	161	
		2722.095	300	33	2722.05	5D	Fe I	97	-0.05
							Fe II	260	
		2373.357	300	38	2373.36	5w	Al I	4	0.00
		2956.170	100	49	2956.13	5	Ti I	1	-0.04
		2652.497	200	53	2652.49	6	Al I	1	-0.01
25	Mn II	3059.060	100	[21]	3059.11	8W	Fe I	[9]	+0.05
		2883.825	100	69	2883.72	6w	Fe II	230	-0.10
							Fe I	167	
		2656.170	200	70	2656.14	5	Fe I	156	-0.03
		2662.538	200	70	2662.58	5	Fe II —	410	+0.04
		2943.894	200	82	2943.91	6	Ni I	24	+0.02
		2728.617	300	—	2728.63	4	Vd II	1	+0.01

Table 2 — Selected Masked Lines — Continued

Z	Spectrum	Lab $\lambda$	Lab Int.	Mult No.	Solar $\lambda$	Solar Int.	Solar Ident.	Mult No.	$\Delta\lambda$ Solar - Lab
25	Mn II cont.	2593.301	250	—	2593.24	5	Mg I Fe I	— 171	-0.06
26	Fe I	2795.540	30	44	2795.53	6W	Mg II	1	-0.01
		2908.856	8	142	2908.81		Vd II	12	-0.05
		2851.509	5	159	2851.64		Mg I	5	+0.13
		2606.644	4	—	2606.61		Mg I	—	-0.03
26	Fe II	2142.993	1	6	2143.01	5	Vd II	7	+0.02
		2186.842	8	90	2186.89	7	Fe I	22	+0.05
		2196.012	9	—	2196.04	7W	Fe I	21	+0.03
		2168.914	4	247	2168.80	6W	Al I	9	-0.11
		2175.113	2d	247	2175.15	6	Ni II	13	+0.04
		2954.050	4	253	2953.93	8W	Fe I	1	-0.12
		2490.728	4	331	2490.65	7W	Fe I	9	-0.08
		2796.644	4h	373	2795.53	Mg II	—	—	-1.11
		2289.495	10	15	2289.61		Si I	88	+0.11
27	Co I	2198.75	8	23	2198.71	6	Ge I	11	-0.04
		2764.188	7	52	2764.14	5D	Fe I	—	-0.05
		2325.601	3	63	2325.56	5d	Mg II Fe II Co I	— — 14	-0.04
27	Co II	2205.833	5B	10	2205.88	6	Fe I	—	+0.05
		2697.040	40	13	2697.02	5	Fe II	100	-0.02
		2714.447	80	13	2714.42	7W	Fe II	63	-0.03
		2487.400	50	16	2487.37	6d	Fe II	385	-0.03
		2317.069	500B	—	2317.16	7W	Ni I	8	+0.09
		2275.387	200	—	2275.45	6	Ca I	—	+0.06
		2447.696	200B	—	2447.71	6w	Fe I	9	+0.01
		2524.208	5	28	2524.28	6W	Fe II	320	—
		2211.03	3	34	2210.97	4	Fe I	7	+0.07
28	Ni I	2186.94	2	37	2186.89	7	Fe II	118	-0.06
		2551.034	10	17	2551.10	5	Fe I	134	—
		2545.903	200	18	2545.97	6W	Mg I	22	-0.05
		2135.127	250	—	2135.32	5D	Fe I	—	+0.07
28	Ni II	2406.664	1500	19	2406.66	8W	Fe I	7	+0.07
		2138.546	500R	24	2138.58	8W	Fe I	—	+0.19
		2545.903	200	18	2545.97	6W	Ni I	18	—
		2135.127	250	—	2135.32	5D	Cr II	23	—
29	Cu I	2406.664	1500	19	2406.66	8W	Fe I	2	0.00
		2138.546	500R	24	2138.58	8W	Zn I	1	+0.03
		2551.034	10	17	2551.10	5	Ni II	13	—
		2545.903	200	18	2545.97	6W	Fe I	24	—

Table 2 — Selected Masked Lines — Continued

Z	Spectrum	Lab $\lambda$	Lab Int.	Mult No.	Solar $\lambda$	Solar Int.	Solar Ident.	Mult No.	$\Delta\lambda$ Solar - Lab
40	Zr II	2712.38	10	3	2712.39	4	Fe II	201	+0.01
41	Nb II	2941.536	800R	14	2941.49	5	Vd II	10	-0.05
		2910.580	400R	14	2910.64	4	Cr II	211	+0.06
42	Mn II	2890.995	100	4	2891.06	6	Ti II	5	+0.06
		2923.387	100	4	2923.42	5D	Cr II	240	
							Fe I	—	+0.03
							Cr II	286	
44	Ru II	2678.759	800	40	2678.79	7	Cr II	7	+0.03
46	Pd II	2488.92	300	13	2488.94	5	Fe I	164	+0.02
49	Cd II	2265.018	1000	1	2265.06	6	Fe I	16	+0.04
50	Sn I	2706.510	1000R	1	2706.52	5	Ni I	70	+0.01
		2429.488	1000R	4	2429.51	3	Cr I	64	
		2354.837	1000R	4	2354.88	6W	Fe II	180	+0.02
							Fe II	35	+0.04
51	Sb I	2528.52	2000R	8	2528.51	7W	Si I	1	-0.01
		2598.05	1500R	8	2598.37	9W	Fe II	1	+0.32
56	Ba II	2335.269	10R	2	2335.21	5d	—	—	-0.06
58	Ce II	2976.900	320	—	2976.90	4	Fe I	172	0.00
58	Ce III	3055.589	100000	[1]	3055.70	4	Fe I	—	+0.11
72	Hf II	2975.886	3000	7	2975.93	5	Fe II	60	+0.04
		2647.294	600	11	2647.25	4			-0.04
74	W I	2944.398	500R	5	2944.40	6W	Fe II	78	0.00
76	Os I	2909.061	500R	1	2909.04	4	Cr I	12	-0.02
77	Ir I	2849.725	80r	1	2849.84	7	Cr II	5	+0.12
		2543.971	200h	5	2543.91	6	Fe I	162	-0.06
78	Pt I	2893.87	6	3	2893.88	4	Fe I	88	+0.01
		2733.96	8R	3	2734.00	5	Fe I	48	+0.04
		2719.02	6R	6	2719.04	8W	Fe I—	5	+0.02
							Fe I	161	
79	Au I	2700.90	30	4	2700.92	5	Vd II	1	+0.02
		2688.72	20	6	2688.70	5	Vd II	3	-0.02
82	Pb I	2801.991	50000R	2	2802.70		Mg II	1	+0.71
90	Th II	2837.295	1000r	—	2837.30	4	Fe II	231	0.00

## PART III

### GENERAL DISCUSSION

By the time of the commencement of World War II a great deal had already been learned about the chemical composition and the physical structure of the sun from diligent work on its "accessible" spectrum. The first evidence that short-wavelength emissions must exist came from the need to explain the earth's ionosphere. Proof that extreme ultraviolet radiation is emitted from the sun came soon after 1940 from the identification of the long-unexplained coronal lines in the visible (Grotrian 1939 and Edlén 1942). The green coronal line 5303 Å, for example, was produced by a forbidden transition in Fe XIV whose excitation required the emission of lines in the extreme ultraviolet near 265 Å.

The success in 1946 in obtaining observations from a V-2 rocket of the ultraviolet solar spectrum, pointed the way toward eventually observing the entire spectrum of the sun, a long-cherished dream of astronomers. New interest in the observation of the sun was immediately generated. Following the first twenty years of research based on rocket spectra, a general summary of the situation just prior to the availability of the echelle spectra was given in the 1966 Solar Monograph (Moore, Minnaert, Houtgast).

#### Summary of Spectra Identified

The raias ultimes of twenty-nine spectra lie within the range covered by the echelle spectrograph (Table 3). These raias ultimes include 11 first spectra, 16 second spectra, and 2 third spectra. They are the lines of these spectra that one would expect to be the strongest in the sun.

Twenty-three of the raias ultimes are present in the solar spectrum, four are masked, and two are absent. Those that are present are indicated by the symbol + following the wavelength in column 5 of the Ledger.

A summary of the spectra identified in the Ledger is presented in Table 4, which includes 34 first spectra, 29 second spectra, 2 third spectra, and 2 molecular spectra. Columns 1 and 2 of Table 4 contain the atomic number and the spectrum, with molecular spectra entered at the end. Columns 3 and 4 give the approximate numbers of unblended and blended solar lines ascribed to each spec-

trum. Column 5 indicates the solar intensity of the strongest unblended line, with Mg I and Mg II omitted for reasons that are obvious.

#### Some Identifications of Special Interest

Hg I: In the 1966 Solar Monograph,<sup>42</sup> Table 13 contained a summary of "Chemical Elements in the Sun," and stated that "Further study of Hg I is needed." On the basis of the present work Hg can now be considered present in the sun. See details below.

C II: Although the spectra of carbon through C VI are now familiar features in extreme ultraviolet solar spectra, when progressing from the visible to shorter wavelengths the first accessible lines of C II occur in the echelle range.

Cu II and Cd II: These spectra are observed in the sun for the first time from the presence of their raias ultimes.

Pt II: This spectrum is listed as present from the echelle data.

Yt III and Gd III: These third spectra appear in the list of newly identified spectra. For Yt III the evidence is provided by the raias ultime.

B I, Tc II, Ce III, Tb II and Th II: The leading lines of these spectra fall within the echelle range and might be expected to be present. They are absent or masked. Special discussions of these spectra follow in the section "Comments on Spectra Absent from the Echelle Ledger."

Li I: The raias ultime, 6707.761 Å,<sup>20</sup> is strong in the spot spectrum but is absent from the disk spectrum because of the low ionization potential of Li I. The second series member, 3232.634 Å, is absent. The third member, 2741.186 Å, agrees with a solar line observed at 2741.21 Å, but this is considered to be a chance coincidence.

Tm III: The strongest line observed in the laboratory, 2489.437 Å,<sup>54</sup> is absent.

OH and SiO: Molecular spectra of OH and SiO have been identified in the echelle range and are described in the section on "Molecular Spectra." OH lines are familiar and numerous, but SiO is reported here for the first time.

Pending further observations, no identifications of the NH band at 3050 Å have been entered in the Ledger.

Table 3 — Raies Ultimes

Z	Spectrum	Lab	Z	Spectrum	Lab
4	Be I	2348.610	43	Tc II	2543.227 <sup>a</sup>
5	B I	2497.7233 <sup>m</sup>	44	Ru II	2402.72
12	Mg I	2852.127	45	Rh II	2334.77
12	Mg II	2795.528	46	Pd II	2296.53
14	Si I	2516.112	47	Ag II	2246.43 <sup>a</sup>
24	Cr II	2835.63	48	Cd I	2288.018
25	Mn II	2576.105	49	Cd II	2144.408
26	Fe II	2382.034	58	Ce III	3055.589 <sup>m</sup>
27	Co II	2286.150	71	Lu II	2615.42
28	Ni II	2216.482	72	Hf II	2641.410
29	Cu II	2135.981	76	Os I	2909.061 <sup>m</sup>
30	Zn I	2138.573	77	Ir I	2543.971 <sup>m</sup>
32	Ge I	2651.172	78	Pt I	2659.44
39	Yt III	2817.037	79	Au I	2427.95
42	Mo II	2816.153			

<sup>a</sup> = absent<sup>m</sup> = masked

## Notes on Selected Spectra

**Z = 12; Mg I:** The strength of the raike ultime, 2852.127 Å, is enormous. Other series are well represented. The series  $3p\ ^3P^o - ns\ ^3S$  is present from  $n = 6$  to 13; for  $n = 14$  to 21 the wavelengths are predicted. The series  $3p\ ^3P^o - nd\ ^3D$  is present from  $n = 5$  to 18 and may run to  $n = 22$ ; wavelengths from  $n = 14$  are predicted.

**Mg II:** The analogs of H and K of Ca II, 2795.528 Å and 2802.704 Å, are the dominant features of the entire echelle range. Three series have been

extended to the ultraviolet and identified from predicted wavelengths:

$4s\ ^2S - np\ ^2P^o$  ( $n = 6, 7$ )

$3d\ ^2D - nf\ ^2F^o$  ( $n = 10$ )

$4p\ ^2P^o - ns\ ^2S$  ( $n = 10, 11$ ).

**Z = 13; Al II:** The series limits associated with the ground term  $3p\ ^2P^o$  lie at 2070.626 Å and 2075.443 Å. Absorption in the several series converging to these limits and beyond accounts for most of the great decrease in

Table 4 — Summary of Spectra in the Echelle Ledger: Counts of Lines

Z	Spectrum	Unbl.	Bl.	Intensity	Note	Z	Spectrum	Unbl.	Bl.	Intensity	Note
4	Be I	3	5	4h	1	38	Sr I	4	1	3	2
6	C I	3	2	4h		39	Sr II	1	1	3	2
	C II	2	2	2h		40	Yt II	1	1	3	2
12	Mg I	>60	>30		1,2	41	Yt III	1	0	2	1,2
	Mg II	10	7		1,2	42	Zr I	6	4	3	
13	Al I	>40	>30	7	2	43	Zr II	40±	25±	5	
	Al II	2	1	5	2	44	Nb II	4	0	3	2
14	Si I	>30	>10	9W	1,2	45	Mo I	1	0	1h	2
	Si II	2	2	2	2	46	Mo II	3	3	2	1,2
15	P I	7	11	5	2	47	Ru I	0	1	1±	2
20	Ca I	10	2	6	2	48	Ru II	3	3	3	1,2
	Ca II	6	2	5	2	49	Rh II	1	0	1	1
21	Sc I	1	2	1	2	50	Pd II	1	0	4	1
	Sc II	6	1	5	2	51	Cd I	1	0	5	1,2
22	Ti I	70±	35±	5	2	52	Cd II	1	0	3	1,2
	Ti II	90±	40±	6		53	Sn I	1	0	1	2
23	Vd I	30±	25±	4		54	Sb I	2	0	3h	2
	Vd II	150±	70±	6		55	Ba II	2	1?	4	2
24	Cr I	160±	100±	6		56	Ce II	6	2	3	
	Cr II	280±	180±	7	1	57	Gd II	3	2	3	
25	Mn I	80±	50±	6	2	58	Gd III	2	0	1	2
	Mn II	120±	80±	8W	1	59	Lu II	0	1	?	1,2
26	Fe I	770±	260±	9W	2	60	Hf II	4	2	3	1
	Fe II	>800	>300	9W	1,2	61	W I	2	0	1	2
27	Co I	200±	100±	6w		62	Os I	1	0	1h	1,2
	Co II	100±	70±	7w	1	63	Ir I	4	1	3	1,2
28	Ni I	130±	50±	8W	2	64	Pt I	9	7	4	1
	Ni II	100±	50±	7W	1	65	Pt II	0	1	2±	2
29	Cu I	22	8	5	2	66	Au I	3	7	3	1,2
	Cu II	14	8	5	1,2	67	Hg I	1	0	3	2
30	Zn I	6	2	5	1	68	Pb I	0	1	3h	2
31	Ga I	4	0	4	2	69	OH	87	75	5	2
32	Ge I	11	1	5	1,2	70	SiO	41	29	2	2
33	As I	2	0	2	2						

Note 1 See Table 3, Raies Ultimes

Note 2 See "Notes on Selected Spectra" below

intensity of the solar continuum short of 2100Å. Many lines in these series are present, mostly from two series:

$3p\ ^2P^o - ns\ ^2S$  ( $n = 5$  to 17);  $n = 17$  predicted

$3p\ ^2P^o - nd\ ^2D$  ( $n = 4$  to 16).

Al II: In multiplet 1, 2669.157Å is unblended; in multiplet 14 only the strongest member, 2637.689Å, is present and is faint. The singlet line, 2816.185Å multiplet 7, is probably blended with the riae ultime of Mo II, 2816.153Å.

Z = 14; Si I: Nearly 50 lines are present and many are strong. (see Table 5). A paper on "The Presence of Si I series in the Ultraviolet Solar Spectrum 3000Å to 1200Å" was published in 1977.<sup>41</sup>

Si II: The 4 identified lines are from multiplets 0.01 and 17.

Z = 15; Pt I: This spectrum was first identified in the sun from lines of  $\lambda > 9100\text{\AA}$  (Moore, Babcock and Kiess 1934). This earlier work is well confirmed by the presence of some 20 low-level lines in the echelle range.

Z = 20; Ca I: The series  $4s^2\ ^1S - 4s\ np\ ^1P^o$ , of which 4226.727Å is the leading member, extends from  $n = 5$  to 9.

Ca II: The identifications are based on predicted wavelengths, all believed to be reliable.

Z = 21; Sc I: Multiplets [10] and [11] are faintly present. The one unblended line is 3014.364Å.

Sc II: Three leading lines of multiplet 1 are unblended. The remaining lines are from multiplets 2 and [37].

Z = 22; Ti I: The strongest multiplets, 1, 2, and 5, are well represented, and contain only a few blends.

Z = 25; Mn I: The strongest lines are from multiplet 1 and are unblended.

Z = 26; Fe I: The ultimate lines of Fe I are among the strongest Fraunhofer lines (see Table 5). Almost every known line of Fe I is present in the spectrum of the solar disk and many as yet unidentified lines are probably lines of Fe I.

The most extensive line list of Fe I is found in the paper "Iron-Neon Hollow Cathode Spectrum" by H. M. Crosswhite.<sup>7</sup> In addition C. M. Brown and associates<sup>1</sup> have observed Fe I in absorption from 2142Å to 1550Å; more than 60 of these lines have been identified in the echelle spectrum. About 70 unclassified lines of Fe I from the early Princeton line list<sup>51</sup> have also been identified.

Use was made of two extensive lists of predicted Fe I lines that have not been published<sup>43</sup>: a list by J. L.

Tech, based on "Atomic Energy Levels" and 12 miscellaneous levels,<sup>29</sup> and a similar list by C. M. Brown, which includes recent work by U. Litzén.<sup>31</sup> More than 200 of these predicted lines have been identified in the echelle spectrum.

Fe II: A revised and extended analysis of Fe II by S. Johannson<sup>23</sup> was used extensively. In addition, wavelengths predicted from Johannson's term values provided identifications of more than 30 unidentified solar lines. The most important predicted lines are found in multiplets 4 and 32.

Z = 28; Ni I: The strongest lines are from multiplet 24. The following unclassified lines have been identified from UV, Ref A:

Laboratory Wavelength	Int.	Laboratory Wavelength	Int.	Laboratory Wavelength	Int.
2277.767	6	2313.649	5	2703.615	2
2308.168	4	2322.683	5	2903.653	1
2309.484	4	2346.074	3	2932.618	4
2310.016	3	2559.655	6		

A few Ni I lines have been identified from predicted wavelengths.<sup>38</sup> The level values in Ref. 48 have been used.

Z = 29; Cu I: Only the strongest lines from the two lowest terms are present.

Cu II: The presence of the riae ultime provides the first evidence of Cu II in the solar spectrum. This spectrum has excellent "Reference Wavelengths".<sup>25</sup>

Z = 31; Ga I: Three lines from multiplet 1 and one from multiplet 3 appear to be unblended.

Z = 32; Ge I: The leading lines, multiplets 1 and 2, are present and unblended. A few lines from the second lowest term are also present. All of the Ge I lines are in the list of "Reference Wavelengths".<sup>25</sup>

Z = 33; As I: The presence of As I in the sun was reported in 1976.<sup>39</sup> The riae ultime, 1890.42Å, was identified by C. M. Brown in a rocket spectrogram and all three members of multiplet 1 appear to be present. On the basis of this evidence two lines near 2300Å in the echelle spectrum have been attributed to the leading lines of As I, multiplet 6.

Z = 38; Sr I: Five members of the series  $5s^2\ ^1S - np\ ^1P^o$  ( $n = 6$  to 11) appear to be present but faint; one is masked.

Sr II: The two leading lines of multiplet 3 near 2160Å appear to be present but faint.

Z = 39; Yt II: The two leading lines of multiplets 1 and 2 are accessible and present.

**Yt III:** The leading lines of multiplet 3 are 2817.037 $\text{\AA}$  and 2946.014 $\text{\AA}$ . The solar line 2817.04 $\text{\AA}$  is identified as Yt III and provides the first evidence of the presence of this spectrum. The second line is absent.

**Z = 41; Nb II:** The identified lines are from multiplets 9, 14 and 15. The riae ultime, 3094.172 $\text{\AA}$ , is outside the present range.

**Z = 42; Mo I:** Only the strongest accessible line, 2225.437 $\text{\AA}$  multiplet 2, is present; it is faint and hazy.

**Mo II:** Six lines of multiplet 4 are present but faint; three are blended.

**Z = 44; Ru I:** The leading line of multiplet 1, 2874.984 $\text{\AA}$ , may contribute to a solar line of intensity 3 due mostly to Cr II.

**Ru II:** Five lines of multiplet 41 and the strongest line of multiplet 42 are the only lines entered as present.

**Z = 48; Cd I:** In the 1966 Solar Monograph<sup>42</sup> the low-level intersystem line of Cd I, 3261.050 $\text{\AA}$ , was listed as present. The presence of the riae ultime as an unblended line in the echelle spectrum confirms the earlier work.

**Cd II:** The riae ultime is the violet component of a close pair of lines. The second member of multiplet 1 is masked. No other lines of Cd II have been observed in the solar spectrum.

**Z = 50; Sn I:** A faint solar line at 2863.30 $\text{\AA}$ , is identified as Sn I (multiplet 1).

**Z = 51; Sb I:** The two accessible lines in multiplet 1 are present but faint.

**Z = 56; Ba II:** Multiplet 2 is present. The second and third lines are unblended. The strongest line, 2335.269 $\text{\AA}$ , probably contributes to the double solar line 2335.21 $\text{\AA}$ , intensity 5d, which is unidentified. The wavelength discrepancy is unexplained; therefore the Ba II line is listed in Table 2 as masked.

**Z = 64; Gd III:** The two leading lines, 2955.534 $\text{\AA}$ , and 2904.726 $\text{\AA}$ , appear to be present, but faint. This is the first identification of Gd III in the solar spectrum.

**Z = 71; Lu II:** The presence of the riae ultime as the principal contributor to a solar blend confirms the presence of three lines attributed to Lu II in the 1966 Solar Monograph.<sup>42</sup>

**Z = 74; W I:** The strongest accessible line, 2946.989 $\text{\AA}$ , is very faint in the echelle spectrum. The presence of the second line, 2818.060 $\text{\AA}$ , is dubious.

**Z = 76; Os I:** The riae ultime is masked. A weaker but strongly reversed line, 2838.626 $\text{\AA}$ , multiplet 12, appears to be present but faint.

**Z = 77; Ir I:** The identification of Ir I at  $\lambda > 3000\text{\AA}$  is confirmed by the presence of three reversed laboratory lines in the present range. The riae ultime is masked.

**Z = 78; Pt II:** The first and only evidence of Pt II in the solar spectrum is from 2144.244 $\text{\AA}$ , which is observed in the laboratory as a blend of Pt I and Pt II.

**Z = 79; Au I:** In the 1966 Solar Monograph<sup>42</sup> one line, 3122.784 $\text{\AA}$ , is identified as Au I; this was the only evidence of gold in the sun. In the echelle range the presence of 10 lines confirms the earlier assignment. Blending is troublesome, but the strong line 2352.58 $\text{\AA}$ , multiplet 5, is unblended. The riae ultime is blended with Mn II.

**Z = 80; Hg I:** The familiar intersystem line, 2536.517 $\text{\AA}$ , multiplet 1, is present in the echelle spectrum. The correctness of this identification is supported by the riae ultime, 1849.492 $\text{\AA}$ , multiplet 2, found present in absorption in a rocket spectrogram photographed by NRL. This solar line was measured at 1849.50 $\text{\AA}$  and identified by C. M. Brown. These two solar lines are the first and only lines attributed to Hg I.

**Z = 82; Pb I:** The strong line, 2833.060 $\text{\AA}$ , multiplet 1, may contribute to a solar line due partly to Fe II. The first line in multiplet 2 is masked by Mg II.

#### Comments on Spectra Absent from the Echelle Ledger

**Z = 5; B I:** The search for B I in the solar spectrum has been unrewarding,<sup>39</sup> and this holds true for the echelle spectrum as well. The leading lines, 2497.7233 $\text{\AA}$  and 2496.7717 $\text{\AA}$ <sup>11</sup> are masked. The solar line in the present ledger at 2496.77 $\text{\AA}$  is attributed to an unclassified line<sup>7</sup> of Fe, 2496.792 $\text{\AA}$ , rather than to B I. The analysis by Kchl et al. (1977) of the Harvard-Smithsonian spectrum for B I does not take into consideration this line of Fe.

**Z = 43; Tc II:** The possible presence of technetium in the sun was noted in 1951 on the basis of leading lines of Tc II longer than 3000 $\text{\AA}$ , but the evidence was inconclusive.<sup>36</sup> The riae ultime, 2543.227 $\text{\AA}$ , multiplet 1, is absent from the echelle spectrum. The second line in the multiplet, 2609.993 $\text{\AA}$ , coincides with a line of Fe ascribed to the faint solar line 2610.00 $\text{\AA}$ . The third member of the multiplet is absent.

As was stated<sup>36</sup> in 1951, the identification depends upon the existence in nature of an isotope having a half-

life "of the order of  $4 \times 10^8$  years or more." More recently, Cahn and Glashow (1981) state that the most stable isotope has a half-life of only  $4.2 \times 10^6$  years. Therefore, no definitive statement regarding the presence of Tc is justified.

$Z = 58$ ; Ce III: This spectrum deserves special mention. The rarest ultime,  $3055.589\text{\AA}$ <sup>53</sup> is masked in the echelle spectrum. In the 1966 Solar Monograph<sup>42</sup> a faint Rowland line at  $3055.594\text{\AA}$  is identified as "Ce III?", the only third spectrum included.

$Z = 65$ ; Tb II: E. Meinders<sup>34</sup> reports 32 strong, classified lines in the echelle range. Of these, only 2 might be present unblended:  $2897.444\text{\AA}$  and  $2914.755\text{\AA}$ , having respective solar intensities 1 and 2. This evidence is so dubious that no solar lines have been attributed to Tb II. The presence of Tb II in the sun still remains questionable, as stated in 1966.<sup>42</sup>

$Z = 90$ ; Th II: The rarest ultime,  $4019.129\text{\AA}$ , provides the only evidence of the presence of a radioactive element in the solar spectrum. The next strongest line,  $2837.295\text{\AA}$ <sup>59</sup>, is masked by Fe II in the present ledger.

### Molecular Spectra

OH: the leading bands of the  $A^2\Sigma^+ - X^2\Pi$  system, (0-0), (1-1), and (2-2), are strongly represented in the solar spectrum at  $\lambda > 3000\text{\AA}$ .<sup>40</sup> They account for 175 unblended solar lines and contribute to 124 blends. In the above reference it is noted that the (1-0) and (2-1) bands should be present and "may be detected when high-dispersion rocket spectra become available." In fact, the (1-0), (2-1), (0-0), and (3-2) bands fall in the echelle region and are present, the (1-0) band being the strongest with the leading lines,  $2833.843\text{\AA}$  and  $2835.530\text{\AA}$ , each having solar intensity 5.

Approximate counts of the identified OH lines are as follows:

#### OH $A^2\Sigma^+ - X^2\Pi$

Band	Unblended	Blended	Total
0-0	10	3	13
1-0	56	46	102
2-1	14	20	34
3-2	7	6	13
<b>Total</b>	<b>87</b>	<b>75</b>	<b>162</b>

SiO: The  $A^1\Pi - X^1\Sigma^+$  system is judged to be present in the echelle spectrum. Some 70 lines are entered in the ledger; about 40% are blends. The evidence comes from (0-1), (1-0), and (2-0) bands.

The strongest unblended SiO lines have intensity 2. The visibility of the lines varies with the contrast in the spectrum, the stray light level, and with the presence or absence of strong competing lines, especially in the presence of broad and winged features. This accounts for the fragmentary appearance of the branches. Solar temperatures of 4000-5000K, which prevail in the solar atmosphere where SiO would be present, would require the rotational lines to peak in intensity at quantum number  $N = 40$ . The observations are consistent with this behavior.

A summary of the values of  $N$  for the lines identified in the three branches of the SiO bands is as follows:

$\text{SiO } A^1\Pi - X^1\Sigma^+$   
Observed Rotational Quantum Numbers (N)

Band	P Branch	Q Branch	R Branch
0-1	absent	45-58	24-37, 49-65
1-0	31-38	16-47	24-50
2-0	absent	72-92	70-89

The (0-0) band should occur between  $2345\text{\AA}$  and  $2388\text{\AA}$ , but laboratory observations are lacking. The wavelengths in this interval have been calculated from the constants of the  $X^1\Sigma^+$  state and the energy levels of the  $A^1\Pi$  state determined from the (0-1) band, as given by A. Lagerqvist and U. Uhler.<sup>31</sup> The evidence for the (0-0) band from these data was inconclusive; hence no lines from the (0-0) band are included in the ledger.

Although some lines in the various branches studied are absent and numerous lines are masked, enough are present or accounted for to confirm the presence of SiO.

The counts of identified lines of SiO are given below:

#### $\text{SiO } A^1\Pi - X^1\Sigma^+$

Band	Unblended	Blended	Total
0-1	9	13	22
1-0	19	12	31
2-0	13	4	17
<b>Total</b>	<b>41</b>	<b>29</b>	<b>70</b>

NH: The presence of NH in the solar spectrum is well established in the 1966 Solar Monograph.<sup>42</sup> The (0-0) and (1-1) bands of the  $A^3\Pi_u - X^3\Sigma^-$  transition are red-degraded and have short wavelength limits at 3280 $\text{\AA}$  and 3307 $\text{\AA}$ , respectively. They are represented in this Monograph by 265 lines, 159 of which are unblended.

The (1-0) band is expected near 3050 $\text{\AA}$ . This wavelength is at the extreme end of the present compilation, and overlaps a poorly observed region of the Rowland Table where the solar observations are discontinuous and fragmentary. Therefore, no identifications have been made, although this band may well be present. Laboratory observations by R. N. Dixon<sup>9</sup> indicate that the (1-0) band is of strength comparable to the (0-0) and (1-1) bands. Further laboratory observations of the (1-0) band are needed.

### Interpretation of Winged Lines

In the course of the early work on the Revision of Rowland's Preliminary Table of Solar Spectrum Wavelengths, (St. John et al. 1928) a study was made of the winged lines in the solar spectrum, 3000 $\text{\AA}$  to 9000 $\text{\AA}$  (Moore and Russell 1926). The strong, winged lines and those lines which were conspicuously hazy were selected by examining the Rowland and Mount Wilson photographs of the solar spectrum. These selected lines, totaling 138 were "subdivided into four groups according to the degree of widening"; group 1 contained the least widened lines and group 4 included only the H and K lines of Ca II. Eleven elements were represented: Fe, Mg, Ca, Ni, H, Ti, Na, Al, Si, Cr, and Sr.

By listing the widened lines of each spectrum in multiplet form it was shown that all originated in low energy levels, those from the lowest levels being the most widened. Strong members of multiplets were more widened than the weaker ones. The order of the elements listed above is roughly that of decreasing "total widening."

The study of the winged lines can now be extended to 2100 $\text{\AA}$  from the data in Table 1. Allowance must be made, however, for the fact that for  $\lambda > 3000\text{\AA}$  the lines were selected from prints, while in the present work, the selection was made from photometric tracings. The earlier work has been extended by the same method of analysis. The lines in Table 1 have been divided into five groups according to the degree of widening, where Group 1 represents the least widened and Group 5 only the Mg lines. The distribution by groups is as follows:

Group	1	2	3	4	5
Width ( $\text{\AA}$ )	0.3-0.5	0.6-0.9	1.0-1.9	2.0-5.0	>5.0

The winged lines are listed by spectra and in multiplet form in Table 5. The multiplets are taken from the Ultraviolet Multiplet Table except for one line of Fe I, 2983 $\text{\AA}$ , which is from the Princeton Multiplet Table of 1945 as indicated by placing the multiplet number in brackets. These references are "UV" and "MT" respectively, in the solar ledger. The wavelengths quoted in the Table are those given in the Ledger. In some cases they differ from those in the Multiplet Tables because later reference material was used. The last column gives the widths grouped as described above. As was noted in the 1926 paper, the lines having the lowest excitation potentials are the most widened, in general, and the leading members of multiplets are widened more than the weaker ones.

Table 6 is a summary of the estimates of widening of winged lines in the echelle spectrum. A total of 76 unblended lines is included. The number of lines of each spectrum in Table 1 is tabulated for each width-group. Most of the lines are due to Fe and the strongest are produced by Mg. This table is essentially an extension of Table II in the 1926 paper, where it is stated that "The main cause of widening is shown .... to be almost entirely the abundance in the solar atmosphere of atoms which are in a condition to absorb the line in question." The extension of the range of the solar spectrum to 2100 $\text{\AA}$  provides a more balanced comparison of widening and abundance. For example, the ultimate lines of Si II can now be included, whereas only one faint line (EP = 1.90 eV) was accessible at  $\lambda > 3000\text{\AA}$ . Mn II is also added. The earlier conclusions are well-confirmed in the present work.

### Counts of Lines in the Ledger

The total number of lines recorded in the ledger is 6150. Of these, 3820 (62%) have been assigned a single identification, and 1100 (18%) are judged to be blends of two or more lines. In spite of careful literature search, some 20% or 1230 lines still remain unidentified. The strongest unidentified lines are listed in Table 7, which includes all unidentified lines having a solar intensity 4 or greater, totaling 150. These lines, in particular, are a challenge to those who continue work on the interpretation of XUV solar spectra.

Table 5 — Winged Lines: Spectra and Multiplets

Wavelength Å	Laboratory				Multiplet No.	Sun	
	Int.	E P	J	Int.		Int.	Width
<b>Mg I</b>							
2852.127‡	300R	0.00	0-1		$3s^2 1S - 3p^1 P^o$ 1	—	5
2779.831	12	2.70	2-2		$3p^3 P^o - 3p^2 3P^{\dagger}$ 6	7W	1*
2779.831	12	2.70	1-1				1*
<b>Mg II</b>							
2795.528‡	50	0.00	0½-1½		$3s^2 S - 3p^2 P^o$ 1	—	5
2802.704	50	0.00	0½-0½			—	5
2936.509	35	4.41	1½-0½		$3p^2 P^o - 4s^2 S^{\dagger}$ 2	7W	2*
<b>Si I</b>							
2516.112‡	250r	0.03	2-2		$3p^2 3P - 4s^3 P^o$ 1	9W	3
2519.202	100r	0.01	1-1			8W	1
2528.509	175r	0.03	2-1			7W	1
2524.108	125r	0.01	1-0			7W	2*
2506.897	150r	0.01	1-2			8W	1
2514.316	100r	0.00	0-1			8W	1
2881.579	200r	0.78	2-1		$3p^2 1D - 4s^1 P^o$ 43	8W	4
2435.154	100r	0.78	2-2		$3p^2 1D - 3d^1 D^o$ 45	7W	2
<b>Mn II</b>							
2576.105‡	400	0.00	3-4		$a^7 S - z^7 P^o$ 1	8W	2
2593.722	300	0.00	3-3			7W	3
2605.682	1000	0.00	3-2			6W	1
<b>Fe I</b>							
2983.570	125R	0.00	4-3		$a^5 D - y^5 D^{\dagger}$ [9]	8W	2
2966.898	125R	0.00	4-5		$a^5 D - y^5 F^{\dagger}$ 1	9W	3
2973.235	60R	0.05	3-4			8W	2*
2973.132	60R	0.09	2-3			7W	2*
2936.903	60R	0.00	4-4			8W	2*
2947.876	60R	0.05	3-3			8W	3
2953.940	50R	0.09	2-2			8W	2
2912.157	20r	0.00	4-3			7W	1
2719.028	60R	0.00	4-3		$a^5 D - y^5 P^{\dagger}$ 5	8W	4*
2720.903	40r	0.05	3-2			7W	4*
2723.578	15	0.09	2-1			6W	2
2742.406	30r	0.09	2-2			6W	2
2737.310	20r	0.11	1-1			6W	3*

Table 5 — Winged Lines: Spectra and Multiplets — Continued

Wavelength Å	Laboratory				Multiplet No.	Sun	
	Int.	E P	J			Int.	Width
<b>Fe I cont.</b>							
2522.849	40R	0.00	4-4		$a^5D - x^5D^o \dagger$	8W	1
2527.435	15r	0.05	3-3	7		7W	1
2501.132	20R	0.00	4-3			7W	2
2510.835	15R	0.05	3-2			7W	1
2524.293	8r	0.11	1-0			6W	2*
2549.613	10r	0.05	3-4			6W	1?
2545.978	10r	0.09	2-3			6W	2
2540.972	10R	0.11	1-2			6W	2
2483.271	60R	0.00	4-5		$a^5D - x^5F^o \dagger$	8W	2
2488.143	40R	0.05	3-4	9		8W	2
2490.644	30R	0.09	2-3			7W	3*
2491.155	20R	0.11	1-2			6W	3*
2462.647	10r	0.00	4-4			8W	1
2472.910	12R	0.05	3-3			8W	1
2479.776	20R	0.09	2-2			7W	2
2788.104	30	0.86	5-6		$a^5F - y^5G^o \dagger$	7W	2
			44				
<b>Fe II</b>							
2599.395	14	0.00	4½-4½		$a^6D - z^6D^o \dagger$	9W	4*
2611.873	13	0.05	3½-3½	1		9W	3
2617.618	12	0.08	2½-2½			8W	3
2621.669	10	0.12	0½-0½			8W	2
2585.876	13	0.00	4½-3½			9W	4
2598.369	14	0.05	3½-2½			9W	4*
2607.086	13	0.08	2½-2½			9W	3
2613.820	13	0.11	1½-0½			8W	3
2625.664	13	0.05	3½-4½			8W	3
2631.321	13	0.08	2½-3½			8W	3*
2631.045	13	0.11	1½-2½			8W	3*
2628.291	13	0.12	0½-1½			8W	3
2382.034‡	9	0.00	4½-5½		$a^6D - z^6F^o \dagger$	9W	4
2395.627	9	0.05	3½-4½	2		9W	4
2404.882	9	0.08	2½-3½			9W	3
2410.521	9	0.11	1½-2½			8W	3*
2413.308	9	0.12	0½-1½			8W	2
2373.733	8	0.00	4½-4½			8W	2
2388.629	9	0.05	3½-3½			8W	3
2399.237	9	0.08	2½-2½			8W	2
2406.660	9	0.11	1½-1½			8W	1
2411.062	9	0.12	0½-0½			8W	3*
2343.495	8	0.00	4½-3½		$a^6D - z^6P^o \dagger$	9W	4
2332.798	8	0.05	3½-2½	3		9W	3
2327.391	7	0.08	2½-1½			7W	2
2364.825	8	0.05	3½-3½			8W	2
2348.300	8	0.08	2½-2½			8W	2*

Table 5 — Winged Lines: Spectra and Multiplets — Continued

Wavelength Å	Laboratory			Multiplet No.	Sun	
	Int.	E P	J		Int.	Width
<b>Fe II cont.</b>						
2338.005	8	0.11	1½-1½	$a^6D - z^6P^o$ †	9W	4
2380.757	7	0.08	2½-3½	3	8W	1
2359.111	8	0.11	1½-2½	continued	8W	3*
2359.999	8	0.23	4½-4½	$a^4F - z^4F^o$ †	7W	3*
2331.308	7	0.23	4½-3½	35	7W	1
2354.884	5	0.35	2½-1½		6W	1
2348.118	8	0.23	4½-3½	$a^4F - z^4D^o$ †	7W	2*
2360.287	8	0.30	3½-2½	36	7W	3*
2368.593	7	0.35	2½-1½		7W	2
2375.192	7	0.38	1½-0½		7W	1
2379.275	7	0.30	3½-3½		7W	1
2755.733	15	0.98	3½-4½	$a^4D - z^4F^o$ †	8W	2
2749.324	14	1.04	2½-3½	62	7W	3*
2746.487	14	1.07	1½-2½		7W	3*
2743.196	14	1.09	0½-1½		7W	1
2739.545	15	0.98	3½-3½	$a^4D - z^4D^o$ †	8W	3
2746.978	14	1.04	2½-2½	63	7W	3*
2749.178	13	1.07	1½-1½		7W	3*
2749.482	12	1.09	0½-0½		6W	3*
2714.414	13	0.98	3½-2½		7W	2
2727.549	13	1.04	2½-1½		7W	2
2736.968	12	1.07	1½-0½		6W	3*
2562.535	13	0.98	3½-2½	$a^4D - z^4P^o$ †	7W	2
2563.472	12	1.04	2½-1½	64	6W	1
2566.908	9	1.07	1½-0½		6W	1
2582.582	10	1.07	1½-1½		6W	2
2577.920	9	1.09	0½-0½		7W	1
<b>Ni I</b>						
2337.484	50	0.00	4-3	$a^3F - w^3D^o$ †	7	m
2317.159	50	0.16	3-2	8	7W	1
2329.963	50	0.27	2-1		7W	1
2320.026	100	0.00	4-5	$a^3F - y^3G^o$ †	8W	1
2325.794	50	0.16	3-4	9	7W	1
2310.952	100	0.00	4-4	$a^3F - w^3F^o$ †	8W	2
2312.335	50	0.16	3-3	10	7W	1

† Riae Ultima.

† Complete multiplet not listed.

\* Blend.

m Masked.

Table 6 — Winged Lines — Estimates of Widening

Spectrum	Degree of Widening					No. lines	Total Widening
	5	4	3	2	1		
Fe I			2	11	7	20	35
Fe II		5	10	12	10	37	84
Mg I	1					1	5
Mg II	2					2	10
Si I		1	1	1	4	7	13
Ni I				1	5	6	7
Mn II			1	1	1	3	6

Table 7 — Strongest Unidentified Solar Lines

Wavelength Å	Int.								
2121.91	6	2282.73	4	2434.68	4	2619.03	5	2736.88	5
2129.12	4d	2286.85	4	2452.84	4	2624.13	4	2740.88	4
2144.44	4	2290.49	4	2463.63	4	2634.35	4	2753.80	4
2154.34	4	2294.86	4	2466.30	4	2636.79	5	2753.86	4
2168.36	4	2300.30	4	2469.94	4	2636.96	4	2753.98	4
2175.92	4	2310.78	4	2500.23	4	2639.16	4	2759.91	4
2181.65	4	2313.35	4	2500.65	4	2647.25	4	2774.02	4
2198.43	4	2315.59	5	2509.27	4	2648.45	4	2778.75	4
2203.54	4	2319.24	4h	2555.78	4	2649.23	4	2781.00	4
2204.09	5	2321.45	5	2559.33	4	2649.63	4	2791.51	4
2205.88	6	2323.09	4	2565.02	4	2652.10	4	2813.07	4
2224.47	6	2325.13	4	2565.74	4	2652.16	4	2813.16	4
2232.89	4	2327.23	4	2569.93	4	2653.26	4	2816.77	4
2234.18	4	2328.59	5w	2570.48	5	2657.44	4	2835.38	4
2237.73	4	2331.77	5	2570.93	4	2661.67	5	2837.04	4
2240.27	4	2343.74	5	2575.32	4	2663.64	4	2842.90	4
2242.88	5	2345.84	4	2582.80	4	2666.44	5	2843.79	5
2243.39	4	2346.74	4	2585.26	4	2669.41	4	2878.63	4
2246.29	4w	2347.08	4	2590.31	4	2678.65	4	2883.65	4
2249.26	5	2347.88	4	2590.93	4	2679.21	4	2888.03	4
2257.67	4	2349.14	4	2594.43	4	2688.24	4	2908.19	4
2262.45	4	2349.62	4	2596.43	5	2696.37	4	2909.87	4
2267.37	4	2353.55	4	2597.14	4	2698.03	4	2918.16	4
2268.47	4	2354.09	4d	2599.14	4w	2698.76	4	2925.52	4
2269.04	5	2356.58	5	2604.01	5	2722.32	4	2942.99	4
2270.07	5	2420.53	4	2614.33	4	2723.78	4	2957.63	4
2270.44	5	2420.60	4	2615.21	4	2734.44	4	2962.40	4
2272.70	5	2423.02	4	2615.99	5	2735.01	5d	2965.88	4
2279.57	4	2424.65	4	2616.40	4d	2736.20	4	3039.60	4w
2280.10	4	2425.42	4	2617.36	4w	2736.75	5	3058.96	4

## PART IV

### OTHER SOLAR OBSERVATIONS

High-resolution solar spectra in wavelength ranges that overlap or lie within the range of the present ledger have been obtained by several other groups. In the analysis of the echelle spectra no use was made of these later spectra, other than the occasional examination of an uncertain feature, or the search for a line expected but not found. Thus, the present solar line list is independent of results obtained by others. Similarly, the identifications are independent of identifications proposed by others; they depend only on the results from original laboratory spectroscopic work and the multiplet tables quoted as UV and MT.

The user of this ledger is encouraged, however, to make comparison with the results obtained by others. To facilitate comparison, a listing of relevant publications together with brief comments is presented in this part.

#### The Range Accessible from the Ground

A revision of the ultraviolet spectrum in the range 3650 Å to 3000 Å has been published by Mohler and Mitchell (1969). This was based on new tracings of the solar spectrum obtained with the McMath-Hulbert vacuum spectrograph in Michigan, and also with a similar instrument operated at the Mt. Wilson Observatory. Intercomparison with the Second Revision of Rowland's Table (Moore, Minnaert, Houtgast 1966) resulted in the reporting of several hundred new lines and proposed identifications.

The most extensive revision of the solar spectrum has been carried out by Pierce and Breckenridge (1973) with the McMath solar telescope at the Kitt Peak National Observatory (KPNO). In the range 2975 Å to 3069 Å the total number of lines listed is approximately the same as in the echelle ledger. Between 2918.82 Å, the limit of the spectrum recorded by the KPNO, and 2975 Å, the present echelle ledger contains about half again more lines. The wavelength accuracy of the KPNO results is exceedingly high, owing to the availability of a large number of photographic spectra, and the fact that standard spectra from a thorium hollow-cathode lamp were exposed on many of the plates just above and below the solar spectrum.

#### The Harvard-Smithsonian Atlas 2252 Å to 3196 Å

On May 15, 1974 the Harvard-Smithsonian Center for Astrophysics flew an Aerobee rocket carrying a Fastie-Ebert photoelectric scanning spectrophotometer having a spectral resolution of 0.028 Å. The results are presented in an Atlas (Kohl et al. 1978). Curves of intensity distribution are given for the center of the solar disc, and also for a region near the limb ( $\mu = 0.23 \pm 0.04$ ).

From the point of view of spectral resolution the NRL and Harvard-Smithsonian curves are much alike, as should be, since the FWHM of the respective instrumental profiles was nearly the same. Likewise, each Atlas has regions where the data suffer from excessive noise, photographic and photoelectric. The intensity information in the Harvard-Smithsonian is superior, owing to the use of photoelectric recording, and because the stray-light level associated with the holographic grating and photoelectric detection was low.

#### The Hawaii Atlas — 2678 Å to 2931 Å

On June 19, 1974, only a month after the Harvard-Smithsonian flight, an echelle spectrograph with photographic recording was flown by Allen, McAllister, and Jefferies (1978) of the University of Hawaii. Culminating a development commenced in 1958 by McAllister and Rense at the University of Colorado, this instrument made use of an echelle grating crossed with a plane grating ruled with 1200 grooves per mm. Owing to the availability of a greatly improved echelle grating of 79 grooves per mm, a spectral resolution of the order of 0.02 Å was achieved. Long-wavelength stray light was suppressed by the use of "solar blind" reflecting coatings (Hass and Tousey, 1959; Austin, 1969). Wavelengths were determined by reference to 350 lines, selected with the aid of the NRL Atlas and Preliminary Ledger. Rather than rely on photographic photometry for deriving values of the intensity, the curves were normalized in 5-Å intervals to the Harvard-Smithsonian Atlas. Over the range that it covers, the Hawaii Atlas is definitive. No line list has been published.

### The Interferometer Spectrograph — 2756Å to 2831Å

A spectrograph that combined an echelle grating and a Fabry-Perot interferometer in crossed dispersion was developed jointly by the Culham Laboratory and the Queen's University of Belfast. (Bradley 1968; Bates et al. 1969, 1971). The spectral range covered on the flight of December 1968 was 2765Å to 2822Å, with a spectral resolution of 0.03Å. Improvements made in the instrument led to the attainment of 0.016Å-resolution over the interval 2756Å to 2831Å on November 27, 1969. A line list with identifications was published for the first spectra by Greve, McKeith and McKeith (1973) and another by Greve and McKeith (1974) for the second spectra. Identifications made in the latter were updated by Greve and McKeith (1977) from a comparison with the Harvard-Smithsonian Atlas.

In the first publication the solar line list was compared with the NRL Preliminary List, then available as a private communication. Although the spectral resolution of both instruments was about 0.03Å, more lines were listed than were found by NRL and there were many differences. Some of the differences can be attributed to the use of the NRL Ledger that was preliminary and from which some 10% of the solar lines in this range were discarded when preparing the Final Ledger. However, this is not a sufficient explanation because the line list from the second flight of the interferometric instrument contains only about 15% more lines than are present in the first list for the same spectral range, even though the spectral resolution was improved by a factor of two. Furthermore, the two interferometric lists are not in as close agreement as might be expected, especially for lines that are broad or weak. A detailed comparison with the Final Ledger has not been attempted. The agreement is believed satisfactory for the stronger lines, but not so for those that are weak.

### Short Wavelength Echelle Spectra

An echelle spectrograph with all-reflecting optics that covered a spectral range of approximately 1000Å was designed and constructed by the Culham Laboratory group (Boland, Jones and Engstrom 1971a). Both this instrument and the NRL spectrograph used replicas of the same echelle master grating. The all-reflecting design made it possible to suppress stray light of longer

wavelengths by the use of selectively reflecting coatings and therefore to reach a shorter wavelength limit. From the flight of April 22, 1969 the spectra spanned the interval 2206.270Å to 2019.273Å with a resolution of 0.03Å, the same as for the NRL spectra. Improvements made in the reflecting coatings and thermal stability made it possible on the flight of March 20, 1973 to reach 1400Å and to secure a resolution of 0.025Å. (Boland et al. 1975)

A line list with identifications and analyses was published for the 1969 spectra by Boland et al. (1971b). In general there is excellent agreement with the present Ledger. The list extends about 85Å to shorter wavelengths and contains more lines as the end of the NRL coverage at 2095Å is approached. A revision of the list from the 1969 spectra, taking into account the spectra obtained in 1973, has not come to our attention.

### Identifications Made by Others

The line identifications of Greve, McKeith and McKeith (1973) and of Greve and McKeith (1977) differ from those in the present ledger because of the inclusion of all lines from the laboratory literature that were in wavelength agreement with the particular solar feature to within the resolution-element of the spectrograph. In the NRL ledger, many such lines were excluded after consideration of the lack of importance of their contributions to the solar features, in order to identify the solar lines as positively as possible.

The line identifications of Boland et al., (1971b) were based mainly on the ultraviolet multiplet tables of Moore (UV), and the tables of Junkes, Salpeter and Milazzo (1965). They are consistent, in general, with those in the present ledger.

The line identifications included in the Harvard-Smithsonian Atlas were made by a procedure quite unlike that used in the present work. The identifications are based mainly on the exhaustive compilations of atomic *gf*-values published by Kurucz and Peytremann (1975) and are presented in the form of a synthetic spectrum. A recent extension of the spectral synthesis work by Kurucz and Avrett (1981) includes contributions of several molecular species.

As a final check on the major remaining unidentified lines in the present work, the 1975 compilation of *gf*-values was searched by C. M. Brown for coincidences. The only coincidences that were considered significant were found in Fe II.

## PART V

### ACKNOWLEDGMENTS

Completion of this publication brings to an end a project which commenced twenty years ago. In the preparation of this final ledger, the work was divided as follows: Selection of the solar lines that appeared to be real features, estimation of their visual intensities, and the final determination of wavelengths were carried out by R. Tousey, who has had the overall responsibility for the program since its inception. In close association since the very beginning has been C. E. Moore. Identification of the solar lines and the decisions as to contributors, blending, and masking were her responsibility. C. M. Brown supervised the work on molecular lines and surveyed the literature. The section on Molecular Spectra was provided by him. In addition, he has taken charge of the computer programming and the preparation of the tables for publication.

To thank individually all who contributed to this extended project is hardly practicable. We are most grate-

ful to all who have participated. Contributions best described as invaluable were made by several colleagues formerly at NRL. J. D. Purcell developed the instrumentation and prepared the spectra in a form suitable for study. L. E. Giddings prepared the first line list and P. A. Simmons provided the identifications in the preliminary list. E. Milone contributed in many ways during more than a decade of part-time association. The Atlas was the responsibility of S. G. Tilford.

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**PART VI**  
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**Appendix**  
**THE ECHELLE LEDGER**

The Echelle Solar Spectrum

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2095.46	3	Fe I	31	2095.462	1	2103.05	2	Fe I	31	2103.053	1
2095.67	3	Si I	95.04	2095.64	37	2103.21	1	Si I Ca II	95.03 9	2103.205 2103.235	37 12
2096.04	2	Al I Fe I	28	2096.037 2096.059	38 1	2103.36	1	Ni II	31	2103.392	52
2096.68	3 W	Al I		2096.609	15	2103.66	5 W	Al I Al I		2103.658 2103.680	15 15
2097.09	3	Ni II	31	2097.094	52	2103.97	1	Fe I	31	2103.973	UV
2097.51	4 W	Fe II Fe II	120 80	2097.508 2097.548	23 23	2104.40	2	Fe I		2104.412	1
2097.90	3	Al I? Fe I		2097.860 2097.875	38 1	2104.76	2	Cu II	15	2104.797	25
2098.13	3	Fe I	31	2098.119	1	2105.11	1	Cu I	23	2105.112	UV
2098.71	5 W	Al I		2098.735	15	2105.25					
						2105.33	2				
2099.00	5 W	Fe I Al I	34	2098.939 2099.060	1 14	2105.50	2				
2099.75	5 W	Al I		2099.765	15	2105.82	2	Ni I?	43	2105.85	48
2100.16	1	Fe I	34	2100.146	1	2106.06	3	Mn I		2106.052	4
2100.38	1	Fe I		2100.393	43	2106.26	3	Fe I	31	2106.259	1
2100.64	1	Cr II? Fe I	16 28	2100.61 2100.612	UV 1	2106.39	5	Fe I	33	2106.395	1
2100.81	4	Fe I	33	2100.798	1	2106.54	1				
2101.02	1	Fe II	250	2101.008	23	2106.70	2	Fe I		2106.692	1
2101.32	1					2106.82	3	Co I	90	2106.82	UV
2101.46	1	Fe I		2101.475	1	2107.16	4	Fe I		2107.144	1
2101.65	1					2107.27	2				
2102.34	5	Fe I	33	2102.355	1	2107.53	3	Al I Fe II	250	2107.526 2107.555	14 23
2102.58	2	Al I		2102.558	14	2107.80	3	Fe II	80	2107.794	23
2102.81	1	Al I		2102.806	14	2107.94	3	Cr II Ni II	16 60	2107.92 2107.954	UV 52
2102.91	2	Fe I	34	2102.910	1						

The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2108.16	3	Fe I	28	2108.136	1	2112.08	3	Cu II	55	2112.100	25
		Fe II	81	2108.137	23	2112.18	2	Cr II	15	2112.16	UV
		Fe I		2108.193	1			Ni II	60	2112.40	
2108.30	2	Fe I	34	2108.303	1	2112.43	1	Co I	83	2112.450	UV
2108.60	6	Fe I		2108.578	1	2112.58	2				52
		Al I		2108.596	14						
		Al I		2108.626	15						
2108.70	5	Fe I		2108.720	1	2112.75	5	Ca II	9	2112.757	12
2108.96	5	Fe II	227	2108.942	UV	2112.97	6W	Fe I	33	2112.969	1
		Fe I	33	2108.961	1	2113.12	6	!Fe I	81	2113.087	1
2109.08	1	Fe II	227	2109.097	UV	2113.54	3	Ca II	9	2113.146	12
		Fe II	250	2109.097	23			Co I	87	2113.53	UV
2109.20	1	Fe I		2109.204	1	2113.83	2	Ni II	60	2113.579	52
2109.29	1					2113.95	3				
2109.44	1					2114.17	1				
2109.60	3	Mn I		2109.585	4	2114.43	5	Ni I	64	2114.43	UV
2109.76	2	Ni I	17	2109.79	UV	2114.63	7W	!Fe I	33	2114.600	1
2110.00	6W	Fe I		2109.893	1			Si I	4	2114.631	37
		Al I		2109.998	15						
2110.23	3	Fe II	290	2110.243	23	2114.98	5	Al I		2114.991	15
		Fe I	31	2110.245	1	2115.18	3	Fe I	33	2115.170	1
2110.44	3	Fe II		2110.436	23	2115.34	2	Co I	80	2115.35	UV
2110.71	3	Fe II	80	2110.724	23	2115.68	1h	Fe II	250	2115.699	23
		Fe II	108	2110.734	23	2116.04	3				
2110.91	1					2116.32	1				
2110.98	1	Cr II	26	2110.98	UV	2116.45	2				
2111.23	3	Fe I	31	2111.232	1	2116.54	2	Al I		2116.542	14
2111.42	3	!Fe I		2111.436	1						
		Co II	2	2111.446	18	2116.69	1				
2111.63	2	Fe I		2111.637	1	2116.76	1				
2111.70	4	Ni I	17	2111.73	UV	2116.86	3	Co I	24	2116.83	UV

The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2116.92	2	Fe I	81	2116.914	1	2121.91	6				
2117.01	3	Fe II Ti I?	213	2116.993 2117.021	23 58	2122.20	5	Fe I	26	2122.178	1
2117.31	2					2122.43	3	Fe II		2122.454	23
2117.47	5	-Vd II	8	2117.482	UV	2122.80	2	Fe I		2122.799	1
2117.70	1	Co I	86	2117.68	UV	2122.96	3	Fe I Cu II Si I	54 49	2122.952 2122.980 2122.994	1 25 37
2117.79	2	Fe I		2117.792	1	2123.12	1	Fe I		2123.124	1
2117.94	3	Co II	2	2117.955	18	2123.36	4	Vd II Al I	8	2123.340 2123.362	UV 14
2118.14	1					2124.12	8W	Si I	48	2124.122	37
2118.21	4	Fe II	120	2118.195	23	2124.80	3	Ni I	63	2124.80	UV
2118.32	5w	Al I		2118.332	15	2124.95	3	Fe I		2124.953	1
2118.54	2w	Co I	80	2118.51	UV	2125.11	3d	Co I Ni II	84 14	2125.10 2125.122	UV 52
2118.66	3	Ca I		2118.672	45	2125.42	2	Fe II		2125.426	23
2119.04	4	Fe II	120	2119.050	23	2125.61	3	Ni I	16	2125.62	UV
2119.14	4	Fe I	28	2119.136	1	2125.91	4w	Ni II	13	2125.914	52
	1	Co I	85	2119.192	UV	2126.06	3w	Cu II	14	2126.045	25
2119.28	4	Fe I		2119.305	1	2126.19	3	Fe I	27	2126.209	1
2119.64	3	Mn II?		2119.65	19	2126.50	1				
2119.88	2	Co I	80	2119.91	UV	2126.60	3	Fe I Au I	2	2126.607 2126.63	UV
2120.55	1					2126.81	3	Fe I Ni II	29	2126.817 2126.838	1 52
2120.75	5w	Fe I		2120.775	1	2126.93	3	Vd II	8	2126.932	UV
2121.07	4	-Fe II	80	2121.099	23	2127.00	2	Fe II		2127.012	23
2121.19	5w	Si I	4	2121.194	37	2127.12	1	Co I	8	2127.14	UV
2121.57	4	Al I		2121.576	14	2127.27	3	Al I		2127.302	14
	1										

The Echelle Solar Spectrum (Continued)

Solar			Laboratory				Solar			Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref		
2127.49	4	Fe I	28	2127.478	1	2131.35	2	Fe II		2131.359	23		
2127.58	2	Fe II	272	2127.602	38	2131.50	4	Ca II	3	2131.505	12		
2127.77	2	Ni II	41	2127.777	52	2131.82	2	Vd II	8	2131.85	UV		
2127.88	5	Fe I		2127.863	1	2132.01	4	Fe I	25	2132.014	1		
2127.95	1	Fe II	29	2127.973	23	2132.30	3	Ca II	3	2132.304	12		
2128.25	2	Vd II	8	2128.241	UV	2132.40	3	Cr II	24	2132.38	UV		
2128.39	3	Ni I	19	2128.41	UV	2132.55		Al I		2132.388	14		
2128.58	4	Ni II	15	2128.583	52			Fe I		2132.532	1		
2128.75	4	Ca II	3	2128.750	12	2132.64	4	Fe II	272	2132.540	23		
2128.93	1					2132.73	3	Cr II	24	2132.62	UV		
2129.12	4d							Cr II	24	2132.62	UV		
2129.47	4	Vd II	7	2129.477	UV	2132.91	2	Cr II	24	2132.93	UV		
2129.66	5W	Al I		2129.663	14	2133.00	3	Cr II	24	2133.03	UV		
2129.89	4	Cr II	24	2129.89	UV	2133.30	3	Fe I	81	2133.310	1		
2129.96	4	Ni I	37	2129.96	UV	2133.46	4	Co II	2	2133.466	57		
2130.15	3							Cr II	23	2133.49	UV		
2130.24	4W	Cr II	14	2130.22	UV	2133.81	2	Cr II	23	2133.81	UV		
		Cr II	24	2130.22	UV	2133.97	2	Fe II		2133.956	23		
		Cr II	79	2130.22	UV			Fe II	213	2134.011	23		
		Fe II	80	2130.254	23	2134.11		Vd II	7	2134.12	UV		
2130.45	3	Fe I	83	2130.409	1	2134.20		Cr II	23	2134.20	UV		
		Fe I		2130.443	1								
2130.57	3	Fe II	249	2130.550	23	2134.27	2	Ni II	31	2134.289	52		
2130.77	2	Cu I?	21	2130.760	32	2134.46	3						
		Ni I		2130.78	UV								
2130.98	5	Fe I		2130.964	1	2134.57		Cr II	23	2134.52	UV		
2131.07	2	Ni II—	31	2131.046	52			Fe II	212	2134.575	23		
		Ni II		2131.099	52	2134.62		Cr II	23	2134.62	UV		
2131.25	4	Ni II	14	2131.265	52								

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2134.74	4	Al I		2134.733	14	2139.31	3	Fe II	80	2139.318	23
		Al I		2134.760	38			Cr II	14	2139.33	UV
2134.90	3	Cr II	23	2134.88	UV	2139.55	3	Cr II	14	2139.54	UV
		Ni I	37	2134.93	UV	2139.69	6w	Fe II	6	2139.640	23
2135.08	2	Cr II	23	2135.09	UV			Fe I	24	2139.701	1
		Fe I		2135.095	1			Fe I	27	2139.701	1
2135.32	5D	Fe II		2135.275	23	2139.80	3	Vd II	7	2139.798	UV
		Fe I		2135.327	1						
		Ni I	18	2135.34	UV	2139.91	4	Fe I	29	2139.929	1
		Cr II	23	2135.34	UV	2140.05	4	Vd II	7	2140.064	UV
2135.45	5D	Cr II- IP I	23	2135.42	UV	2140.14	3	Fe II	120	2140.168	23
			4	2135.465	55						
2135.70	3	Ti II?		2135.73	47	2140.52	3	Cr II	14	2140.50	UV
2135.95	5	Cu II	14	2135.981‡	25	2140.68	2				
2136.16	5	P I	4	2136.182	55	2140.86					
2136.44	5D	Fe I		2136.418	1	2141.07	4	Fe I	26	2141.086	1
		Co II	2	2136.459	18						
		Fe II	249	2136.511	23	2141.46	4	Fe I		2141.467	1
2136.69	1H					2141.73	5	Fe I	25	2141.718	7
2136.92	3	Fe I		2136.937	1	2142.00	4	Vd II	7	2141.973	UV
2137.04	1					2142.14	3	Fe I	30	2142.141	UV
2137.27	3	Vd II	7	2137.31	UV	2142.32	3				
2137.49	1					2142.39	3	Al I		2142.402	14
								Fe II?		2142.416	23
2137.75	5	Fe II	6	2137.748	23	2142.49	3				
2138.02	5	Fe I		2137.997	1			Fe I?		2142.51	51
		Fe II	135	2138.049	23	2142.56	3	Fe I		2142.575	29
2138.14	2	Vd II	7	2138.17	UV	2142.76	1				
2138.58	8W	IZn I	1	2138.573‡	2	2142.83	5	Fe I		2142.820	29
		INi II	13	2138.582	52						
		Fe I	24	2138.585	1	2143.01	5	Vd II	7	2143.038	UV
2139.06	3	Fe I		2139.062	1	2143.37	3	Fe I		2143.369	29
2139.19	2w					2143.55	3	Fe I		2143.545	43

The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2143.72	1					2147.72	2	Fe II	213	2147.704	23
2143.89	5	Fe I		2143.892	29	2147.79	3	Ni I	37	2147.80	UV
2144.07	2	Cr II	14	2144.05	UV	2147.93	3	Si I	94	2147.911	37
2144.22	2	Pt I Pt II	2 12	2144.22 2144.244	UV	2148.06	1	Cr I?		2148.02	28
2144.39	3	Cd II	1	2144.408‡	UV	2148.24	2				
	4					2148.40	3	Fe I	29	2148.394	UV
2144.44						2148.50	3	Fe I?		2148.53	51
2144.57	4	Fe I	81	2144.576	UV	2148.60	3	Fe II	6	2148.606	23
2144.71	2					2148.85	1				
2144.98	1	Fe I	81	2144.947	43	2148.99	3	Cu II	14	2148.984	25
2145.20	4	Fe I	27	2145.189	7	2149.15	5	IP I Fe I	4 80	2149.145 2149.170	55 UV
2145.56	4w	Al I		2145.555	14						
2145.87	2h	Fe I?		2145.86	51	2149.42	2	Fe I	81	2149.416	UV
2146.04	4	Fe II	6	2146.046	23	2149.62	3	Fe I		2149.620	29
2146.28	3	Co I	23	2146.26	UV	2150.17	4	Fe I	25	2150.184	7
2146.37	2	Fe II		2146.367	23	2150.44	4	Si I	95	2150.46	37
2146.47	1	Fe I	83	2146.478	43	2150.62	4	Fe II	135	2150.621	23
2146.61	1	Fe II		2146.609	23	2150.75	7W	Al I		2150.699	14
2146.72	3	Fe I	27	2146.710	UV			Al I		2150.728	38
2146.81	3	Fe I		2146.806	29			Cr II	37	2150.74	UV
2146.99	2					2150.99	1	Fe I		2150.74	UV
2147.04	3	Fe I		2147.045	7	2151.10	3	Fe II	106	2151.090	23
2147.16	2	Cr II	14	2147.19	UV			Fe I	24	2151.099	UV
2147.23	2					2151.23	2	Fe I	25	2151.099	UV
2147.40	2	Co II	2	2147.375	57	2151.66	5	Fe I		2151.695	7
2147.56	3	Al I		2147.560	14	2151.88	4	Fe I?		2151.90	51

The Echelle Solar Spectrum (Continued)

Solar			Laboratory				Solar			Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref		
2152.15	5	Co I	78	2152.15	UV	2156.67	2	Co II	11	2156.652	57		
2152.21		Ni I	38	2152.23	UV	2156.81	2	Ti II	19	2156.804	56		
2152.37	3	Fe II	106	2152.368	23	2156.94	2	Co II	11	2156.937	18		
2152.55	2	Cr I	44	2152.57	UV	2157.23?	2W						
2152.83	3	Sr II	3	2152.84	UV	2157.43	2						
2152.97	6	P I  Fe I	9 27	2152.940 2153.006	33 7	2157.80	4	Fe I Ni I	24 36	2157.794 2157.83	7 UV		
2153.58	2	Fe II		2153.606	23	2157.96	1	Fe II		2157.958	23		
2153.89	2	Fe II	6	2153.904	23	2158.30	3	Ti II  Ni I	19 36	2158.295 2158.31	56 UV		
2154.07	4	P I P I Co I	9 9 24	2154.080 2154.080 2154.08	55 55 UV	2158.50	3D	Fe I Fe II Si I	77 89 2158.526	2158.474 2158.521 2158.526	7 23 37		
2154.34	4					2158.63	2	Fe I	23	2158.630	7		
2154.44	5	Cr I  Fe I	44 77	2154.44 2154.458	28 UV	2158.73	3	Fe I Ni II	2158.734 2158.741	2158.734 2158.741	7 52		
2154.57	1	Ti II?		2154.58	38	2158.90	3	Fe I	24	2158.920	7		
2154.70	3	Ti II	19	2154.709	56	2158.99	2	Fe I		2158.993	29		
2155.00	3	Fe I	25	2155.020	7	2159.08	2	Ti II	19	2159.083	56		
2155.12	4	Fe I?		2155.114	29	2159.15	5	Fe II	6	2159.160	23		
2155.24	5	Fe I Fe I	27 78	2155.238 2155.238	UV UV	2159.42	4	Fe I	27	2159.431	7		
2155.61	4	Ti II	19	2155.596	56	2159.50	2	Ti II	19	2159.513	56		
2155.81	4	Fe I		2155.816	29	2159.65	3	Fe I Fe I Fe II	24	2159.638 2159.658 2159.667	7 7 23		
2155.97	1					2159.89	5	Fe I	24	2159.924	7		
2156.22	2	Cr II	133	2156.22	UV	2160.22	4	Fe I	82	2160.236	UV		
2156.43	3	Fe I		2156.432	29	2160.45	4	Fe II	185	2160.471	UV		
2156.47	3	Fe I	77	2156.504	29	2160.78	2	Fe II		2160.795	23		

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2161.03	3	Ni I	37	2161.04	UV	2165.55	6d	INi II	13	2165.553	52
2161.17	3	Fe II	213	2161.16	23	2165.84	3	Fe II	185	2165.556	23
2161.23	3	Ni II	14	2161.217	52	2165.96	2	Fe I		2165.861	UV
		Fe II	370	2161.313	UV			Sr II	3	2165.93	UV
								Fe I		2165.982	29
2161.58	4	Fe I	27	2161.579	7	2166.19	5D	Ni I—	37	2166.15	UV
		Fe II	119	2161.582	UV			IIFe II	212	2166.225	23
2161.67	1	Cr II	133	2161.66	UV	2166.60	6	Fe I		2166.586	43
2162.02	3	Fe II	90	2162.023	23			Si I		2166.599	37
2162.24	4d	Fe I	44	2162.248	7	2166.77	7W	Fe I	21	2166.773	7
		Cr I	44	2162.25	28	2167.26	2	Fe I	78	2167.271	29
2162.45	3H	Cr I	44	2162.47	UV	2167.40	4	Fe II	119	2167.425	23
2162.67	3	Ti II	19	2162.68	UV	2167.52	2				
2162.84	2	Fe II	89	2162.846	23	2167.70	4	Si I	92	2167.700	37
2163.04	2	Co I	26	2163.02	UV	2167.86	3	Fe II	213	2167.879	23
2163.19	1	Ni II		2163.208	52	2168.04	4	Fe I		2168.057	43
2163.37	4	Fe I		2163.368	UV	2168.27	4	Fe II	6	2168.290	23
2163.58	2	Co I	23	2163.56	UV	2168.36	4				
2163.78	3	Si I	93	2163.773	37	2168.71	5	Co I	23	2168.70	UV
2163.87	4	Fe I	24	2163.860	UV			Fe II	134	2168.720	23
2163.97	2					2168.80	6W	Al I	9	2168.826	14
2164.36	5	Fe II	79	2164.336	23	2169.11	6	Ni II	13	2169.096	52
2164.55	6	IIFe I	24	2164.549	7	2169.59	5W	Cu I—	26	2169.586	32
		Al I	2164.577	14							
2164.63	1	Fe II	213	2164.615	23	2169.86	2	Al I		2169.843	14
								Fe II	119	2169.864	23
2164.88	1					2169.94	3	Fe II	370	2169.950	UV
								Ni II		2169.955	52
2165.09	3	Cu I	4	2165.093	UV	2170.16	5	Fe II		2170.176	23
2165.20	2	Fe II?	151	2165.232	23	2170.56	6	Co I	23	2170.55	UV
2165.27	2							Fe I	77	2170.554	29

The Echelle Solar Spectrum (Continued)

Solar			Laboratory				Solar			Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref		
2170.72	3	Cr II	36	2170.71	UV	2174.48	3	Ni I	36	2174.480	UV		
2171.08	4	Cr II	36	2171.06	UV	2174.59	6W	Co I	19	2174.589	UV		
		Cr II	36	2171.06	UV	2174.68		lNi II	14	2174.666	52		
2171.18	2	Cr II	36	2171.18	UV	2174.85	2	Fe II	135	2174.849	23		
2171.28	7W	Fe I	24	2171.297	7	2175.15	6	Ni II	13	2175.147	52		
2171.55	3	Cr II	36	2171.55	UV	2175.47	6	Fe II	90	2175.451	23		
2171.82	2	Cu I	26	2171.835	32	2175.70	1						
2172.03	2	Fe I	372	2172.037	29	2175.82	1	Sb I	1	2175.81	UV		
		Fe II		2172.044	23	2175.92	4						
2172.13	4	Fe I	23	2172.144	7	2176.01	4	Fe I?		2176.02	51		
2172.19	3	Co I	77	2172.18	UV	2176.22	2	Fe I		2176.216	29		
		Fe I		2172.221	29								
2172.33	2	Fe I	82	2172.332	29	2176.31	2	Fe II		2176.322	23		
2172.57	5	Fe I	23	2172.585	7	2176.38	2	Fe I	79	2176.396	UV		
2172.68	3	Fe I	78	2172.658	29	2176.50	2	Co I	120	2176.48	UV		
		Fe II	372	2172.679	UV			Fe II		2176.501	23		
2172.91	2	Co II?	10	2172.875	57	2176.66	3d	Fe I		2176.670	29		
2172.97	4	Fe II	134	2172.980	23	2176.85	5	Fe I	23	2176.840	7		
2173.22	5	Fe I	24	2173.214	7	2177.02	4	Vd I-	46	2177.00	UV		
								lFe II	106	2177.032	23		
2173.34	2	Co II	2	2173.326	18	2177.09	3	Ni II	40	2177.086	52		
		Co II	10	2173.326	18								
2173.47	1	Fe II		2173.449	23	2177.36	6W	Ni II	40	2177.361	52		
2173.54	3	Ni I	59	2173.535	UV	2177.42		lSi I	91	2177.432	37		
2173.70	3	Fe II	79	2173.691	23	2177.53	3	Fe II	247	2177.542	23		
2173.85	3	Co I	23	2173.82	UV	2177.71	4h	Fe I	80	2177.695	7		
2174.10	6W	Al I	9	2174.071	14	2178.09	8W	Fe I	21	2178.073	UV		
		Al I	9	2174.113	14			Fe I	22	2178.118	7		
2174.29	1					2178.56	3h	Fe I	77	2178.546	43		
								Co I		2178.59	UV		

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2178.81	4	Fe I		2178.797	29	2182.86	2				
2178.95	5	Cu I	3	2178.944	UV	2182.96	1				
2179.36	5	Ni II	40	2179.352	52	2183.23	3	Ni II		2183.217	52
2179.44	6	Cu II Ni II	14 12	2179.410 2179.453	25 52	2183.38	4	Ni I		2183.37	48
2179.55	2	Fe II	119	2179.554	23	2183.48	5	Fe I	23	2183.465	UV
2179.84	2	Fe II	134	2179.851	23	2183.58	2	Fe II	89	2183.571	38
2179.99	3	Ni II	30	2179.990	52	2183.81	4	Fe II	247	2183.789	23
								Fe II		2183.835	23
2180.05	3	Co I	20	2180.060	UV	2183.90	4	Ni I	62	2183.91	UV
2180.24	4	Fe II	370	2180.260	23	2183.97	4	Fe I?		2183.979	51
2180.47	4	Ni II	40	2180.473	52	2184.17	3				
2180.60	2	Co II	23	2180.604	18	2184.30	1	Co I	17	2184.31	UV
2180.69	1					2184.46	3	Fe I		2184.46	29
2180.86	5	Fe I	23	2180.869	7	2184.61	6w	Ni II	13	2184.605	52
2180.98	1	Al I		2180.996	14	2184.69	2	Fe II	79	2184.696	23
2181.13	4	I Co I Fe I	120 20	2181.12 2181.133	UV	2184.91	2	Mn I? I Co I	118	2184.912 2184.92	4 UV
2181.38	2h	Fe II		2181.372	23	2185.09	2				
2181.49	3w					2185.21	3	Fe I	77	2185.216	29
2181.65	4					2185.34	1				
2181.71	5	Co II II Cu I	11 3	2181.716 2181.720	57 UV	2185.49	5	Ni II	40	2185.504	52
2181.99	2	Co II	23	2181.989	18	2185.59	2	Fe II	271	2185.588	23
2182.23	2h	Vd I	46	2182.22	UV	2185.71	1				
2182.38	5	Ni I	16	2182.38	UV	2186.01	3	Co I	81	2186.030	UV
2182.60	4	Co I	23	2182.59	UV	2186.13	1				
2182.77	3	Mn I		2182.773	4	2186.25	5	Fe I	20	2186.250	7
						2186.50	8	Fe I	21	2186.486	7

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2186.77	3	Fe I Co I	73	2186.760 2186.777	29 UV	2190.97	4	Ni II	29	2190.967	52
2186.89	7	Fe I	22	2186.892	7	2191.21	5	Fe I Ni I	22 61	2191.204 2191.21	7 UV
2187.20	7	Fe I	21	2187.195	UV	2191.39	3	Mn I		2191.413	4
2187.28	3	Co I Co I	75 121	2187.28 2187.28	UV UV	2191.84 2192.09	8W	Fe I	21	2191.839	7
2187.44	2	Fe II	271	2187.441	23	2192.26	SD	Cu II	14	2192.268	25
2187.51	2					2192.33		Ni II	40	2192.341	52
2187.60	3	Ni I	16	2187.60	UV	2192.52	5	Co II	22	2192.505	18
2187.68	4	Fe II	89	2187.684	23	2192.82	4	Fe I		2192.819	29
2187.87	5	Fe II	135	2187.868	23	2193.27	2	Cr II	151	2193.30	UV
2188.05	5	Ni II	12	2188.045	52	2193.41	4	Fe I		2193.411	UV
2188.78	5h	-Fe II?		2188.820	38	2193.59	6	Fe I Co II	114 22	2193.564 2193.603	UV 18
2189.03	5	Co II Fe II	11	2188.990 2189.033	18 23	2193.66	2	Fe II		2193.668	38
2189.20	4	Fe I	114	2189.183	UV	2193.76	1	Mn I		2193.762	4
2189.41	6	Fe I	78	2189.393	UV	2194.06	2	Fe I	19	2194.076	43
2189.51	4	Ni II Fe I		2189.498 2189.514	52 29	2194.17	2				
2189.63	3	Cu II	53	2189.630	25	2194.49	3d				
2189.70	2	Fe I		2189.720	29	2194.82	2	Fe I	76	2194.839	43
2190.23	6w	Ni I	36	2190.223	UV	2194.95	1				
2190.41	1					2195.09	2				
2190.53	1	Ni II		2190.557	52	2195.32	1				
2190.68	4	Co II	22	2190.675	18	2195.46	2				
2190.76	5	Fe I?		2190.77	51	2195.57	2				
2190.88	4	Fe I		2190.879	29	2196.04	7W	Fe I	21	2196.043	7
						2196.30	1				

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2196.45	3	Co I	19	2196.458	UV	2201.12	5	Fe I	20	2201.117	UV
2196.61	1					2201.25	2	Co I	76	2201.23	UV
2196.82	2D	Cr II	151	2196.84	UV	2201.41	6	Ni II	13	2201.409	52
2196.98	2	Fe I?		2196.962	43	2201.57	6	Ni I Fe II	60 367	2201.59 2201.595	UV UV
2197.06	2					2202.04	2				
2197.15	1					2202.17	2	Fe II	271	2202.163	38
2197.24	5	Fe I Fe II	20 226	2197.230 2197.263	UV 23	2202.29	1				
2197.35	6	Ni I	36	2197.347	UV	2202.40	1				
2197.67	3w					2202.49	2h				
2197.79	5	Ca II	8	2197.787	12	2202.70	3	Mg II		2202.681	38
2198.31	5	Co II Cr I	10 43	2198.266 2198.32	18 UV	2202.79	1				
2198.43	4					2202.91	2	Co II	1	2202.928	UV
2198.71	6	Ge I	11	2198.714	25	2202.98	4	Co II		2202.951	18
2198.97	2	Fe II?	151	2198.964	38	2203.33	2	Fe I?		2203.328	43
2199.18	5	Al I	8	2199.183	14	2203.42	4	Fe II-	406	2203.420	UV
2199.42	1					2203.54	4				
2199.59	5	Cu I	23	2199.586	32	2203.88	4	-Cr II	13	2203.89	UV
2199.74	6	Cu I	23	2199.750	32	2204.09	5				
2200.00	2					2204.66	7W	Al I	8	2204.619	14
2200.09	2	Fe I		2200.084	29	2204.80	2	Al I	7	2204.668	14
2200.20	2					2205.05	6	Co I	74	2204.796	UV
2200.38	7W	Fe I Co II	21 11	2200.390 2200.410	7 18	2205.21	2w	Co II	22	2205.073	18
2200.49	3	Fe I		2200.494	29	2205.56	6	Cr I	43	2205.20	UV
2200.72	7W	Fe I Ca I	21 7	2200.724 2200.728	7 45	2205.78	1	Co II Ni II	22	2205.547 2205.548	18 52

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2205.88	6					2210.24	2	Cu II	52	2210.268	25
2206.08	3	Fe		2206.083	7	2210.39	4	Ni II	13	2210.382	52
2206.19	6	Co II	22	2206.182	18	2210.70	2	Fe I	18	2210.689	7
2206.33	1	Zr II?	17	2206.31	UV	2210.89	6W	Si I	3	2210.894	37
2206.44	3	Fe I		2206.444	29	2210.97	4	Fe II	118	2210.952	UV
2206.59	4	Fe II	134	2206.582	UV	2211.10	3	Fe II	134	2210.952	UV
2206.71	7W	Ni II	13	2206.715	52			Ni II	52	2211.097	52
2207.07	3	Fe I	19	2207.068	7	2211.25	3w	Fe I	20	2211.234	UV
2207.18	1	Cr II	31	2207.18	UV			Fe II	305	2211.243	UV
2207.73	3	Co I Ni I	22 9	2207.71 2207.74	UV 48	2211.41	4	Co II	10	2211.430	18
2207.85	3	Co I	22	2207.853	UV	2211.74	6w	Si I	3	2211.744	37
2207.90	3	Co II	23	2207.914	18	2212.16	5	Ni I	15	2212.149	UV
2207.98	9W	Si I	3	2207.978	37	2212.34	3	Co I	18	2212.35	UV
2208.28	1	Fe I		2208.280	29	2212.44	3				
2208.41	1	Fe II	367	2208.411	23	2212.59	3				
2208.51	1	Co I	20	2208.508	UV	2212.86	3w				
2208.62	4	Ca II	8	2208.611	12	2213.18	4	Ni II	30	2213.196	52
2208.73	2	Fe I	20	2208.714	29	2213.48	2				
2208.80	4	Mn I		2208.806	4	2213.66	7W	Fe II	168	2213.679	UV
2209.02	5	Fe II	366	2209.029	23	2213.86	7	Co I	21	2213.84	UV
2209.38	2	Cr II		2209.37	27	2214.02	2	Co I	75	2213.84	UV
2209.53	2	Fe I		2209.541	43	2214.11	2	Mn I?	2213.855	4	
2209.74	2	Fe II		2209.723	10	2214.27	4w	Fe I	368	2214.041	23
2210.05	6	Al I	7	2210.060	14	2214.40	4	Fe II	114	2214.257	43
2210.11	5	Al I	7	2210.130	14	2214.49	3			2214.405	10
						2214.58	4	Cu I	22	2214.582	32

The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2214.78	5	Co II	11	2214.793	18	2220.10	4	Co II	22	2220.110	18
2215.06	3	Fe II	369	2215.077	23	2220.21	1	Vd II	28	2220.214	UV
2215.23	2	Fe I?		2215.230	43	2220.29	1				
2215.30?	1	Cr II	12	2215.30	UV	2220.39	6W	Fe II Ni II	118 28	2220.388 2220.402	UV 52
2215.44	3					2220.53	1				
2215.55	2					2220.63	1				
2215.65	5	Cu I	22	2215.654	UV	2220.91	4	Fe I	19	2220.912	UV
2215.87	1					2221.16	5	Fe II	168	2221.160	UV
2216.00	1	Fe II		2216.009	38	2221.32	3	Fe I		2221.34	51
2216.47	7W	Ni II	12	2216.482‡	52	2221.44	2	Ti I?		2221.474	58
2216.68	7W	Si I	3	2216.669	37	2221.82	5	Mn I		2221.837	4
2217.05	2	Fe II	168	2217.048	UV	2221.94	4	Ni I	15	2221.939	UV
2217.28	2	Co II	10	2217.290	18	2222.07	3	Fe I	114	2222.059	29
2217.58	3	Fe I	114	2217.578	UV	2222.16	2				
2217.75	5	Fe I Ni I	20 33	2217.744 2217.77	UV	2222.24	1				
2217.87	1	Cr II?	51	2217.89	UV	2222.36	1				
2218.06	6W	Si I— Cu II	3 13	2218.057 2218.108	37 25	2222.44	3	Fe II	168	2222.446	UV
2218.40	3	Ti I—	18	2218.382	58	2222.60	2	P I Pt I	3 9	2222.579 2222.60	55 UV
2218.81	3	Co I	73	2218.81	UV	2222.66	3	Fe II	369	2222.667	23
2218.91	6	Si I	3	2218.915	37	2222.76	3H	Fe I	113	2222.75	UV
2219.14	2	Co I	16	2219.16	UV	2222.96	6W	Ni II	12	2222.957	52
2219.27	1					2223.19	2h	Ti I	18	2223.199	58
2219.42	3					2223.35	3	P I	3	2223.359	55
2219.70	3	Fe II		2219.712	10	2223.47	6	Fe II	168	2223.481	UV
2219.89	4	Fe II	168	2219.889	UV	2223.76	3	Fe I		2223.747	29

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2223.85	2h	Fe II	368	2223.866	UV	2227.48	2	Fe II	369	2227.469	UV
2224.06	1	Co II		2224.085	18	2227.61	3	Fe II	168	2227.597	UV
2224.14	1					2227.76	3	Cu I	21	2227.771	32
2224.35	5	Ni II	21	2224.355	52	2227.83	3	Co I	16	2227.853	UV
2224.47	6					2228.16	6	Fe I	18	2228.172	7
2224.86	7W	Ni II	12	2224.864	52	2228.22	3	Cr I	42	2228.22	28
2225.10	2	Ti I?		2225.128	58	2228.31	1	Cr II	283	2228.34	UV
2225.33	6	Co I	19	2225.339	UV	2228.49	2	Fe I	19	2228.489	UV
2225.40	1	Ni I	16	2225.35	UV	2228.69	2w				
2225.46	1h	Mo I	2	2225.437	UV	2228.80	2	Fe II Co I	366 19	2228.761 2228.80	UV UV
2225.58	1h					2228.87	2h	Ti II Cu II	13	2228.85 2228.868	47 25
2225.69	4	Cu I	2	2225.697	UV	2229.06	3	Fe I	18	2229.073	7
2225.75	1					2229.22	3	Ti II		2229.25	47
2225.86	5	Co I	120	2225.84	UV	2229.42	3w				
2226.07	1					2229.63	3	Fe I		2229.632	43
2226.24	1	Cr II	35	2226.27	UV	2229.72	3	Co I	68	2229.734	UV
2226.31	7W	Ni II	12	2226.329	52	2229.97	2	Vd II	28	2229.985	UV
2226.41	1					2230.07	6w	-Cu I	21	2230.084	UV
2226.46	1	Cr II	12	2226.47	UV	2230.19	2				
2226.55	1h					2230.36	1	Zr II?	59	2230.38	UV
2226.78	1H	Ti I	18	2226.798	58	2230.44	3				
2226.86	1	Fe I?		2226.85	51	2230.63	1				
2226.95	1	Fe II		2226.962	38	2230.93	6	Ti II Ni I	36	2230.95 2230.955	47 UV
2227.15	4	Ti II		2227.157	56	2231.09	3	Fe I	112	2231.090	29
2227.36	3	Fe II	168	2227.378	38						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2231.20	5	Fe I	18	2231.213	7	2235.63	1				
2231.32	2					2235.73	3	P I	3	2235.732	55
2231.46	3	Cr II	283	2231.45	UV	2235.79	1				
2231.51	3	Fe II	368	2231.505	23	2235.92	2				
2231.64	3					2236.06	1w	Ni II?	53	2236.063	52
2231.75	2	Co I?	74	2231.749	50	2236.29	6w	Cu I-	24	2236.278	UV
2232.07	5	Co II	10	2232.075	18	2236.44	3				
2232.24	2h					2236.53	1w				
2232.41	2	Fe II		2232.406	38	2236.68	6	Fe II	4	2236.680	UV
2232.47	3	Co I	20	2232.460	UV	2236.80	5	Co I	19	2236.796	UV
2232.70	2					2236.95	1w				
2232.76	2	Fe II?		2232.732	38	2237.16	5	Co I	70	2237.125	UV
2232.89	4					2237.22	2	Co I	119	2237.125	UV
2233.09	3					2237.57	4	Vd I?	39	2237.228	UV
2233.20	1					2237.73	4	Fe II	365	2237.577	UV
2233.76	5	Fe II	4	2233.753	38	2237.82	5	Fe I	114	2237.814	UV
		Co I	21	2233.759	UV						
2233.91	5w	-Fe II	118	2233.917	UV	2237.91	3	Fe II	334	2237.894	23
2234.18	4					2238.15	3				
2234.44	5w	Fe I-	114	2234.432	UV	2238.25	4	Fe I	18	2238.259	UV
2234.55	3					2238.44	4	Cu I	25	2238.458	32
2234.70	5	Co I	67	2234.710	UV	2238.55	3				
2234.84	4	Fe I?		2234.87	51	2238.64	2	Fe II		2238.629	23
2234.95	3	P I		2234.958	55	2238.73	2	Ti I	17	2238.750	58
2235.25	3					2238.90	2d				
2235.38	1					2239.02	4	Fe II	365	2239.047	23
2235.52	3	Fe II		2235.514	10						

The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2239.15	2					2243.04	4	Fe I— Yt II	75 1	2243.022 2243.06	43 UV
2239.21	3					2243.25	4d	Co I Cr II	19 77	2243.254 2243.28	UV UV
2239.51	3					2243.39	4				
2239.64	2h	Fe II	334	2239.638	23	2243.59	5	Fe II ICr II	118 77	2243.578 2243.62	UV UV
2239.78	1	Fe II		2239.814	10	2243.73					
2239.98	2					2243.81					
2240.27	4					2243.91	5	Fe I	16	2243.911	UV
2240.33	6	Fe II	4	2240.346	38	2244.05	3				
2240.54	3					2244.14	2				
2240.62	6	Fe I	112	2240.627	UV	2244.21	2	Fe II	365	2244.216	23
2240.90	3					2244.27	4	Cu I	2	2244.265	UV
2241.03	1					2244.45	5	Ni I	34	2244.464	UV
2241.21	3					2244.53	5	Ni I		2244.55	UV
2241.31	2	Cr II	50	2241.30	UV	2244.63	5d	Fe II		2244.600	10
2241.43	5	Fe II	365	2241.426	23	2244.86	4	Cr II	35	2244.83	UV
2241.58	1	Co II		2241.60	57	2244.91	4	Cr II	35	2244.90	UV
2241.65	4	—Cr II?	50	2241.69	UV	2245.13	5	Co II Fe I	10 75	2245.128 2245.14	18 UV
2241.84	6	Fe I	75	2241.85	UV	2245.33	2h				
2241.93	2					2245.39	1				
2242.10	4d	Fe II—		2242.090	38	2245.50	4	Fe II	365	2245.505	23
2242.35	3	Fe II		2242.333	10	2245.65	4	Fe I	18	2245.653	7
2242.59	5D	P I Fe I Cu II	3 18 52	2242.539 2242.579 2242.618	55 UV 25	2245.76	2				
2242.78	5	Fe I	18	2242.776	43	2246.05	4d	—Fe II		2246.060	38
2242.88	5										

The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2246.29	4w					2250.96	4w	Fe II	4	2250.937	UV
2246.62	4	Co I	18	2246.599	UV	2251.10	2h	Co II		2251.12	57
2246.92	4w	Fe II		2246.912	10	2251.22	3	Fe I		2251.228	43
2247.01	4	Cu II	13	2247.002	25	2251.48	4	Ni I	33	2251.484	UV
2247.25	4	Ni II	30	2247.228	52	2251.58	4	Fe II	5	2251.556	UV
2247.46	3	Fe I	72	2247.461	UV	2251.85	5d	Fe II	365	2251.830	23
2247.69	3	Fe II	365	2247.692	23	2252.02	2	Fe I?	18	2251.874	7
2247.90	3	Cr II	49	2247.91	UV	2252.21	1	Nb II?	113	2252.046	43
2248.12	2	Fe II		2248.102	10	2252.32	1		65	2252.210	UV
2248.19	1					2252.48	1H				
2248.31	4	Cr II	49	2248.30	UV	2252.73	5	Co I	20	2252.712	UV
2248.54	3	Cr II	49	2248.56	UV	2252.89	3				
2248.68	3	Co II	9	2248.669	18	2253.12	5w	Fe II	4	2253.119	UV
2248.86	5	Fe I	70	2248.860	7	2253.26	3	Sr I	9	2253.256	16
2249.09	4	Fe II	365	2249.063	23	2253.57	6	Fe II	365	2253.262	38
		Fe II	365	2249.063	23	2253.68	5	Ni I	34	2253.565	UV
2249.18	4	Fe II	365	2249.181	23	2253.78	5	Ni II	29	2253.679	52
2249.26	5					2253.85	6d	Co I	64	2253.760	UV
2249.71	2	Fe II		2249.700	38	2254.10	4w	Ni II	12	2253.848	52
2249.78	4	Cr II	49	2249.78	UV	2254.40	5	Fe II	365	2254.078	23
2249.92	4	Cr II	35	2249.91	UV	2254.82	5	Fe II	365	2254.109	38
		Cr II	35	2249.91	UV	2254.88	4	Fe II	5	2254.401	UV
2249.98	4	Cr II	49	2249.98	UV	2254.96	3	Ni I	14	2254.810	UV
2250.09	4	Ti II?		2250.084	56	2255.16	5	Fe II		2254.893	10
2250.18	5w	Fe II	4	2250.171	UV						
2250.49	1	Co I	117	2250.496	UV						
2250.79	5	Fe I	16	2250.790	7						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory				Ref
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	
2255.24	3					2257.97	4	Cr II	76	2257.96	UV	
2255.34	2					2258.02	6	Al I	6	2258.008	14	
2255.40	3					2258.09	4	Cr II	76	2258.09	UV	
2255.68	4	Fe II	365	2255.691	23	2258.15	5	Ni I	32	2258.145	UV	
2255.76	5	Fe II	133	2255.759	UV	2258.36	4w	Fe II		2258.372	10	
2255.87	6	Fe I Ni I	73 9	2255.865 2255.873	UV	2258.81	3h	Vd II	16	2258.814	UV	
2255.99	5	Fe II Cr II Cr II	4 49 77	2255.979 2256.01 2256.01	UV	2259.00	2					
2256.06	4	Fe I	75	2256.063	29	2259.28	5	Fe I	16	2259.279	UV	
2256.14	4	Ni II	51	2256.137	52	2259.50	5	Fe I	15	2259.511	7	
2256.31	5	Ni I	15	2256.321	38	2259.58	6	Ni I	32	2259.562	UV	
2256.43	4	Fe II		2256.431	10			Si I	90	2259.587	37	
2256.56	4	Co I	67	2256.565	UV	2259.65	4	Fe II	334	2259.589	23	
2256.69	3					2260.02	4	Co II		2259.589	23	
2256.74	4	Co II Fe I		2256.732 2256.750	UV	2260.08	4	Fe II	75	2259.644	43	
2256.90	5	Fe II	365	2256.897	UV	2260.24	5	Fe II	4	2260.078	UV	
2257.00	1	Vd II	16	2256.984	UV	2260.50	1	Cu I	5	2260.228	UV	
2257.08	1	Fe II		2257.096	10	2260.58	5	Fe I	20	2260.528	UV	
2257.16	1h					2260.73	4	Fe II	112	2260.594	UV	
2257.28	1					2260.86	5w	Fe II		2260.750	38	
2257.38	1h					2261.08	3	Vd II	4	2260.853	UV	
2257.62	4	Cr II	76	2257.62	UV	2261.18	5	Fe I?	16	2261.084	UV	
2257.67	4					2261.44	5	Ni I	13	2261.16	51	
2257.74	4	Cr II	76	2257.76	UV	2261.59	3			2261.424	UV	
2257.79	5	Fe II	365	2257.788	23	2261.69	5	Si I	47	2261.693	37	

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2261.81	1h					2265.76	4	Co II	9	2265.739	18
2261.99	2	Fe I		2261.998	43			Fe I	111	2265.763	43
2262.24	3h	Fe II		2262.261	10	2265.89	3w				
2262.33	2h	Cr I	41	2262.32	UV	2266.00	4h	Fe II	5	2265.991	UV
2262.45	4					2266.12	4	Fe II		2266.137	10
2262.61	3	Co I	14	2262.592	UV	2266.24	5	Fe II		2266.241	10
2262.69	5w	Fe II	5	2262.686	UV	2266.34	5	Ni I	33	2266.348	UV
2262.91	3H	Ni II	39	2262.898	52	2266.52	3wh	Co II		2266.533	18
2263.08	4	Cu I	24	2263.084	32	2266.66	2	Cr I	41	2266.66	UV
2263.24	5	Fe II	246	2263.224	UV	2266.70	3	Fe II	315	2266.699	UV
2263.47	5d	Al I	5	2263.463	14	2266.80	2	Co II		2266.797	57
		Fe I	15	2263.476	UV	2266.91	5	Fe I	70	2266.906	7
2263.58	3					2267.09	5D	Fe I	17	2267.085	7
2263.74	6	Al I	6	2263.738	14	2267.16	4	Fe I	18	2267.113	UV
2264.02	3	Ti I?		2264.020	58	2267.25	3			2267.134	43
2264.32	3	Fe II		2264.322	38	2267.37	4				
2264.40	5w	Fe I	71	2264.389	7	2267.47	6	Fe I	70	2267.470	7
2264.46	4	Ni II	12	2264.461	52	2267.55	4	Ni I	10	2267.554	UV
2264.60	4	Fe II	246	2264.589	UV	2267.61	4D	II Fe II - Cr I	4	2267.584	UV
2264.72	3	Fe I	75	2264.703	43			Cr I	41	2267.64	UV
2264.90	4h	Co I	70	2264.880	UV	2267.92	3w	Ti I?	15	2267.912	58
2264.97	3					2268.16	5d	Cr I	41	2268.13	28
2265.06	6	Fe I	16	2265.054	7			Fe II		2268.135	10
2265.37	3	Ni II	39	2265.345	52	2268.28	3w	Co I	67	2268.163	UV
2265.54	3					2268.47	4				
2265.60	4	Fe I	73	2265.61	UV	2268.57	5	Fe II	5	2268.562	UV
						2268.74	4	Co I	69	2268.742	UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2268.84	5	Fe II	5	2268.844	UV	2273.62	4d	Fe II Cr I	41	2273.597 2273.62	10 UV
2269.04	5					2273.75	3	Co II?		2273.732	UV
2269.10	5	Al I Fe I	5 16	2269.096 2269.100	14 7	2273.85	5d	-Fe I	73	2273.893	29
2269.22	5	Al I	5	2269.222	14	2274.09	6	Fe I Fe I	16 70	2274.089 2274.089	7 7
2269.33	3					2274.28	4	Fe I		2274.288	29
2270.07	5					2274.51	5	Co I	14	2274.495	UV
2270.21	6	Ni II	12	2270.214	52	2274.66	6	Ni I	9	2274.662	UV
2270.36	4	Fe I	72	2270.368	29	2274.72	5	Ni II	38	2274.724	52
2270.44	5					2275.00	2				
2270.58	3	Fe I	74	2270.575	43	2275.09	2				
2270.68	4	Fe I		2270.675	29	2275.18	6	Fe I	16	2275.192	7
2270.85	6	Fe I	15	2270.862	7	2275.30	3h	Sr I Cr I	8 41	2275.304 2275.31	16 28
2271.24	5d	-Ni I		2271.256	38	2275.45	6	Ca I		2275.462	45
2271.40	3h					2275.60	4	Fe I	111	2275.597	7
2271.78	6	Fe I	70	2271.783	7	2275.68	4	Ni II	39	2275.684	52
2271.94	5	Ni I	35	2271.951	UV	2275.75	3	Fe I		2275.758	29
2272.06	6	Fe I	16	2272.070	7	2275.90	2	Co I	68	2275.884	UV
2272.25	5h	Co II	9	2272.270	18	2276.02	5w	Fe I	14	2276.026	7
2272.60	5	Fe I		2272.610	29	2276.24	4	Cu II	13	2276.258	25
2272.70	5					2276.30	2	Cr I	41	2276.31	28
2272.80	5	Fe I	71	2272.819	7	2276.44	3	Ni II	51	2276.437	52
2273.02	2	Vd II Vd II	15 171	2273.024 2273.024	UV UV	2276.51	4	Co I		2276.523	50
2273.08	3	Sc II	2	2273.10	UV	2276.68	3	Ti I	15	2276.703	58
2273.27	3	Ti I	15	2273.280	58	2276.76	3				
2273.50	3										

The Echelle Solar Spectrum (Continued)

Solar			Laboratory				Solar			Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref		
2276.92	2h					2281.03	3						
2277.09	5	Fe I	71	2277.105	7	2281.17	2h						
2277.16	2					2281.24	2	Vd II	123	2281.235	UV		
2277.27	4	Ni II	28	2277.282	52	2281.35	2h	SiO	(2-0)	2281.371	30		
2277.49	2H					2281.48	2						
2277.68	5w	Fe I Fe I?	70 112	2277.667 2277.716	7 43	2281.62	5d	Vd II	26	2281.601	UV		
								Fe I	110	2281.629	29		
								Fe I	112	2281.629	29		
2277.76	4	Ni I		2277.767	UV	2281.89	2	Co II		2281.894	18		
2278.04	2					2281.99	4	Fe I	17	2281.986	UV		
2278.15	1					2282.16	2h	SiO	(2-0)	2282.173	30		
2278.28	5	Si I	89	2278.281	37	2282.30	1						
2278.32	5	Ni II	59	2278.318	52	2282.35	1	Co II?		2282.369	18		
2278.63	4d	Fe I	16	2278.614	UV	2282.49	3	Fe II		2282.471	10		
2278.77	5w	Ni II	22	2278.770	52	2282.66	3						
2279.15	3	Fe I		2279.152	29	2282.73	4						
2279.48	2	Co I	67	2279.480	UV	2282.87	4	Fe I	70	2282.865	7		
2279.57	4					2282.94	3						
2279.68	3					2283.09	5	Fe I	71	2283.074	7		
2279.92	5W	I Fe II Fe I	4 16	2279.918 2279.937	UV 7	2283.31	5W	Fe I	16	2283.305	7		
2280.10	4					2283.51	4	Co II	9	2283.515	18		
2280.22	5	Fe I	70	2280.216	7	2283.66	5	Fe I	16	2283.655	7		
2280.32	3	Vd II	123	2280.338	UV	2283.82	1	SiO	(2-0)	2283.822	30		
2280.39	4	Fe II		2280.380	38	2283.91	2						
2280.59	2	SiO	(2-0)	2280.587	30	2283.99	4	Fe II	132	2283.991	UV		
2280.73	3					2284.09	6	Fe I	14	2284.086	7		
2280.95	3	Co II	9	2280.947	18	2284.23	4	Fe II	105	2284.224	UV		

The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2284.40	4	Co I	71	2284.375	UV	2288.40	5	Ni I	34	2288.396	UV
2284.66	2	Cr I	41	2284.67	28	2288.54	1	Fe I	71	2288.559	43
2284.75	3	Vd II	45	2284.748	UV	2288.61	3	Fe I	72	2288.608	29
2284.89	6d	Co I— Vd II	14 26	2284.86 2284.920	UV UV	2288.77	2h	Co I	69	2288.774	UV
2285.09	2					2288.86	2				
2285.22	2d					2288.96	4	Fe I	15	2288.964	43
2285.41	3	Co I	63	2285.408	UV	2289.04	6	Fe I	70	2289.037	7
2285.51	3	Fe II	184	2285.525	UV	2289.25	2h	Vd II	27	2289.219	UV
2285.78	2					2289.35	2	SiO?	(2-0)	2289.380	30
2285.86	5	Cr I?		2285.88	28	2289.61	5	Si I	88	2289.607	37
2286.16	7w	Co II	9	2286.150‡	18	2289.86	3				
2286.35	3	Cr I	41	2286.37	UV	2290.06	6	Ni I	5	2289.982	UV
2286.45	5	Fe I		2286.442	29	2290.25	2				
2286.58?	1					2290.31	1	SiO	(2-0)	2290.303	30
2286.70	1h	SiO?	(2-0)	2286.707	30	2290.49	4				
2286.85	4					2290.55	5	Co I	66	2290.541	UV
2286.98	2							Fe I	71	2290.553	7
2287.09	5	Ni II	22	2287.089	52	2290.61	2				
2287.26	6	Fe I	14	2287.250	7	2290.77	4	Fe I	70	2290.775	7
2287.32	5	Ni I	34	2287.315	UV	2290.90	4	Fe I		2290.907	29
2287.47	4	Fe I		2287.462	29	2291.04	5	Si I	46	2291.034	37
2287.63	5d	Fe I	71	2287.631	7	2291.12	5	Fe I	70	2291.119	7
		Ni II	38	2287.648	52			Fe I	71	2291.119	7
2287.81	5	Co I	64	2287.804	UV	2291.25	2h	SiO	(2-0)	2291.231	30
2288.03	5	Cd I	1	2288.018‡	UV	2291.36	1h				
2288.12	2	As I	6	2288.12	UV	2291.45	4	Co I	68	2291.450	UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2291.57	3					2294.19	2	Ti I	14	2294.200	58
2291.61	4	Fe I	17	2291.627	7	2294.31	1				
2291.75	1h	Ti II?		2291.764	56	2294.39	5w	Cu II- !Fe I	13 14	2294.368 2294.408	25 7
2291.82	3h	Ni I-		2291.808	38	2294.60	5	Fe II	184	2294.603	UV
2291.99	5	Co II	21	2291.982	18	2294.77	1h				
2292.17	1	SiO Mn I	(2-0)	2292.180 2292.189	30 4	2294.86	4				
2292.31	2	Co II?		2292.304	18	2295.02	4	Vd II	26	2294.992	UV
2292.42	4	Fe II		2292.435	10	2295.12	3	SiO-	(2-0)	2295.096	30
2292.52	5	Fe I	15	2292.524	7	2295.22	4	Co I	12	2295.223	UV
2292.58	2	Vd II Vd II	26 179	2292.588 2292.588	UV UV	2295.30	3	Fe I		2295.310	29
2292.75	2	Fe II	315	2292.770	UV	2295.40	4	Si I	46	2295.401	37
2292.86	1	SiO	(2-0)	2292.838	30	2295.50	4d	Vd II !Fe I	26 109	2295.504 2295.535	UV UV
2292.90	1					2295.67	2h	Nb II	9	2295.681	UV
2293.12	5d	Ni I Fe II	32	2293.114 2293.116	UV 10	2295.80	1	SiO	(2-0)	2295.789	30
2293.23	1					2295.90	1	Co II		2295.910	18
2293.37	5	!Co II Co II	9	2293.383 2293.383	18 18	2296.06	5d	Co I	68	2296.038	UV
2293.51	3					2296.19	3	Fe I	111	2296.188	29
2293.58	2h					2296.31	2				
2293.75	3	Ti I- !Fe II	14 184	2293.745 2293.765	58 UV	2296.50	4	Pd II	14	2296.53 #	UV
2293.84	4	Cu I Fe I	19 15	2293.845 2293.848	32 7	2296.55	5	Ni II	21	2296.552	52
2293.93	3					2296.66	4	Fe II	167	2296.662	UV
2293.99	3	Co I	14	2294.003	UV	2296.74	4d	Co I Fe II	67 133	2296.704 2296.769	UV UV
2294.09	3	Fe I		2294.100	29	2296.90	6d	Fe		2296.890	7
								Fe I	14	2296.927	7

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2297.15	6d	Ni II Cr II	11 19	2297.141 2297.17	52 UV	2300.48	4	Fe II		2300.497	10
2297.25	3					2300.60	4	Cr II Fe I	149 108	2300.58 2300.599	UV UV
2297.47	5d	Ni II	11	2297.489	52	2300.71	2	SiO	(1-0)	2300.697	30
2297.78	5	Fe I	14	2297.787	7	2300.77	5w	Ni I	29	2300.774	UV
2297.87	2	SiO	(2-0)	2297.879	30	2300.86	2	SiO	(1-0)	2300.871	30
2298.05	2					2301.02	2	Ni II	39	2301.014	52
2298.12	5H to	SiO	(2-0)	2298.100	30	2301.17	4	Fe I		2301.175	7
		Fe I Fe II	14 133	2298.169 2298.225	7 UV	2301.29	1	SiO	(1-0)	2301.277	30
2298.28		Ni II	21	2298.270	52	2301.40	4w	SiO	(1-0)	2301.277	30
2298.35	2	Co I	67	2298.356	UV	2301.52	1	Co II Fe II	9 184	2301.404 2301.424	18 UV
2298.48	3	Ni II	39	2298.491	52	2301.57	3w	Ni I?		2301.57	48
2298.63	5	Fe I	15	2298.660	7	2301.68	5	Fe I	14	2301.684	7
2298.73	2h	Co II	21	2298.731	18	2302.05	3	Fe I?		2302.06	51
2298.86	2h	Mn I		2298.876	4	2302.14	3				
2298.94	6	Mn II	2	2298.959	19	2302.22	1h				
2299.08	1					2302.41	1	SiO	(2-0)	2302.402	30
2299.22	6	Fe I	14	2299.220	7	2302.48	3w	Ni II	59	2302.479	52
2299.44	5	Fe I	71	2299.453	UV	2302.65	2				
2299.57	1					2302.73	3	Ti I	14	2302.730	58
2299.65	4	Ni II	27	2299.651	52	2302.94	5	Ni I	32	2302.973	UV
2299.75	4h	Co II	21	2299.764	18	2303.00	5	Ni II	11	2302.996	52
2299.84	3	Ti I	14	2299.852	58	2303.05	5	Si I	87	2303.058	37
2300.08	3	Ni II	27	2300.097	52	2303.34	4w	Fe II Si O	167 (1-0)	2303.349 2303.353	UV 30
2300.13	6	Fe I	15	2300.142	7						
2300.25	4	Fe I		2300.242	29						
2300.30	4										

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2303.41	4w	Fe I	15	2303.424	7	2306.17	4	Fe I	71	2306.172	7
2303.50	2	II Co I SiO?	10 (0-0)	2303.504 2303.518	UV 30	2306.40	5w	Fe I	111	2306.382	7
2303.58	4	Fe I	15	2303.581	7	2306.58	4w	SiO-	(1-0)	2306.554	30
2303.84	3	-Ni II	51	2303.848	52	2306.70	1	Fe II SiO	(1-0)	2306.677 2306.704	10 30
2303.97	3d	Co I SiO	62 (1-0)	2303.966 2303.985	UV 30	2306.81	3	Cr II	19	2306.81	UV
2304.07	2	Ti II?		2304.09	38	2306.88	1	Fe SiO	(1-0)	2306.856 2306.883	7 30
2304.19	3	Co I	11	2304.182	UV	2306.99	2h	SiO Co II	(1-0)	2306.966 2307.003	30 18
2304.24	3	Ba II	2	2304.248	UV	2307.19	4	Cr II	19	2307.19	UV
2304.35	2h	SiO	(1-0)	2304.321	30	2307.25		Sr I	7	2307.264	16
2304.45	1	SiO?	(1-0)	2304.484	30	2307.28		3D	Fe II		2307.311
2304.53	3	Fe I		2304.544	29	2307.35		INi I	35	2307.351	UV
2304.64	3	SiO	(1-0)	2304.653	30	2307.39	5	IFe I SiO	(1-0)	2307.374 2307.391	43 30
2304.74	5	Fe I	71	2304.734	7	2307.52	2H	Co II- SiO?	(1-0)	2307.509 2307.556	18 30
2304.88	1h	Fe II		2304.910	23	2307.78	4	Co II	21	2307.749	18
2305.01	5w	Mn II	2	2305.009	19	2307.85	5	Ni II	38	2307.781	52
2305.17	4	Co I	14	2305.169	UV	2308.01	1	Co II	9	2307.851	18
2305.24	4	Ni II	38	2305.239	52	2308.11	1	SiO	(1-0)	2308.008	30
2305.33	2					2308.16	4	SiO	(1-0)	2308.125	30
2305.46	2d					2308.29	1h	Ni I		2308.168	UV
2305.61	1	SiO	(1-0)	2305.602	30	2308.51	4	SiO	(1-0)	2308.279	30
2305.68	3	Ti I	14	2305.665	58	2308.59	1	Ni II	50	2308.518	52
2305.76	1	SiO	(1-0)	2305.773	30	2308.75	2	SiO	(1-0)	2308.595	30
2305.98	2	SiO	(1-0)	2306.001	30			SiO	(1-0)	2308.737	30

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2309.01	6W	Fe I Co I	14 11	2308.999 2309.03	7 UV	2312.55	3	Co II	21	2312.558	18
2309.08	2	SiO Vd II?	(1-0) 26	2309.068 2309.072	30 UV	2312.64	2	Fe II		2312.654	10
2309.20	1	SiO	(1-0)	2309.206	30	2313.10	6	Fe I	14	2313.104	7
2309.48	5w	Ni I		2309.484	UV	2313.20	4	Fe II?		2313.194	10
2309.55	3	-SiO	(1-0)	2309.560	30	2313.31	3	Fe II	288	2313.300	UV
2309.67	2h	SiO	(1-0)	2309.692	30	2313.35	4				
2309.83	3h					2313.51	2H	Al I	12	2313.526	14
2309.89	1	SiO	(1-0)	2309.907	30	2313.60	6	Co II	21	2313.609	18
2310.01	4	Ni I		2310.016	UV	2313.65	3	Ni I Fe I		2313.649 2313.650	UV 29
2310.06	1	SiO	(1-0)	2310.062	30	2313.99	6	Fe II	184	2313.962	UV
2310.17	3	Fe SiO	(1-0)	2310.166 2310.189	7 30	2314.04	5	Ni I	10	2313.976	UV
2310.31	2					2314.17	2h	Co II	9	2314.050	18
2310.78	4					2314.32	1h	Ge I	10	2314.201	25
2310.96	8W	Ni I	10	2310.952	UV	2314.32		Ti I Fe I	14	2314.289 2314.337	58 29
2311.22	4	Fe II	245	2311.224	UV	2314.71	5d	Cr II Fe II?	19	2314.71 2314.715	UV 10
2311.35	4	Co I Co I	15 62	2311.38 2311.38	UV UV	2314.81	4	Cr II	19	2314.81	UV
2311.48	3h	Sb I	1	2311.47	UV	2314.98	6d	Co II- Al I	9 12	2314.965 2314.983	18 14
2311.60	5	Co II	9	2311.606	18	2315.29	1	Fe II		2315.314	23
2311.76	1	SiO	(1-0)	2311.763	30	2315.43	1h				
2311.89	3					2315.59	5				
2312.02	5	Fe II	105	2312.028	UV	2315.77	2h	Fe II		2315.750	23
2312.22	3	Fe II Ni II	27	2312.227 2312.240	10 52	2316.03	6W	Ni II	11	2316.039	52
2312.34	7W	Ni I	10	2312.335	UV	2316.15	5	Co I	14	2316.157	UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2316.24	2					2319.46	3h	Fe I		2319.441	29
2316.35	1					2319.55	3	Cu I	22	2319.563	32
2316.46	1					2319.65	4	-Fe I		2319.680	29
2316.58	1					2319.77	3	Ni II	37	2319.750	52
2316.73	2d	Co I		2316.733	50	2320.04	8W	II Ni I - Cr II	9 19	2320.026 2320.08	UV 27
2316.84	4	Co I	11	2316.843	UV	2320.34	6W	Fe I	14	2320.358	7
2316.84		Co I	64	2316.843	UV						
2317.16	7W	Ni I	8	2317.159	UV	2320.62	1				
2317.36	3	Fe II	183	2317.377	UV	2320.77	1				
2317.52	2h	Al I	12	2317.482	14	2320.86	1				
		Co I		2317.516	50	2320.97	2				
2317.66	2					2321.07	3				
2317.82	3					2321.40	7W	Ni I	9	2321.377	UV
2317.90	4	Fe I	111	2317.898	7	2321.45	5				
2318.16	6	Fe I		2318.151	7	2321.60	4	Al I	12	2321.562	14
2318.33	4	Fe II	183	2318.343	UV	2321.69	5	Fe II	183	2321.687	UV
2318.42	3	Co II	21	2318.430	18	2321.83	3	Fe I		2321.830	43
2318.52	5	Ni II	38	2318.509	52	2321.88	2				
		Fe II	132	2318.534	UV						
2318.67	1	Fe II		2318.648	38	2321.96	6	Ni I	34	2321.953	UV
2318.77	4	Ni I	58	2318.770	UV	2322.05	2	Co II -		2322.018	18
2318.91	2	Mn II?		2318.91	19	2322.21	1				
2319.00	4	Fe I	13	2318.992	43	2322.33	3	Fe II	183	2322.326	UV
2319.09	4	Al I	12	2319.057	14	2322.45	1				
2319.15	1	Co I	13	2319.152	UV	2322.61	2				
2319.24	4h					2322.69	6	Ni I		2322.683	UV
								Fe I		2322.684	29
2319.37	4	Cr II	34	2319.38	UV	2322.94	2	Fe II		2322.949	10

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2322.99	1	Fe		2323.014	7	2326.13	6	Co II	8	2326.111	18
2323.09	4					Co II-		Fe		2326.111	18
2323.15	5	Co I	11	2323.131	UV	2326.23	2	Mn II		2326.22	19
2323.33	1					Fe II				2326.234	10
2323.42	3	Fe I		2323.422	7	2326.30	2				
2323.63	3	Fe I	12	2323.627	29	2326.37	2	Fe II		2326.353	23
2323.67	2					2326.44	6d	Ni II	11	2326.451	52
2323.76	1	Mn I		2323.748	4	2326.48		Co II	8	2326.471	18
2323.86	1					2326.82	1	Fe II?		2326.816	7
2324.05	1					2326.96	2h	C II	0.01	2326.930	37
2324.15	3	Fe I		2324.128	7	2327.23	4				
2324.25	3	Co II	21	2324.235	18	2327.31	3				
		Fe I		2324.260	29	2327.41	7W	Fe II	3	2327.391	UV
2324.31	5w	Co II	8	2324.300	18	2327.64	3h	Co II		2327.672	18
		Fe II		2324.474	10	Fe II		Fe II		2327.675	38
2324.47	1					2327.96	4	Fe II	183	2327.953	UV
2324.65	5	Ni I	14	2324.645	UV	2328.06	3				
2324.88	2w					2328.30	1h	Co I		2328.298	UV
2325.04	4d	Ti II		2325.044	56	2328.59	5w				
		Fe II		2325.050	23	2328.75	2	Fe I		2328.749	7
2325.13	4					2328.86	5d	Mn II		2328.84	19
2325.30	4	Fe II	183	2325.296	UV	2329.02	2	Fe I		2328.851	43
2325.38	1	C II	0.01	2325.398	37	2329.10	3	Mn II			
2325.48	2					Fe I		Fe I		2329.093	29
2325.56	5d	Co I	14	2325.530	UV	2329.10	3	Co II		2329.106	18
		Fe II	288	2325.577	UV	2329.35	1	Fe II		2329.358	23
2325.80	7W	Ni I	9	2325.794	UV	2329.40	1	Vd I	31	2329.529	UV
2325.93	3	Mn II		2325.93	19	2329.51	1				

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2329.63	4	Fe I	12	2329.641	7	2333.97	2h				
2329.73	2	Fe I	13	2329.742	43	2334.10	2d	Fe I		2334.103	43
2329.96	7W	Ni I	8	2329.963	UV	2334.15	2	Co I	62	2334.12	50
2330.09	2					2334.22	3	Cr II	47	2334.17	UV
2330.16	2h					2334.29	1	Cr II	47	2334.24	UV
2330.34	4w	Co II	8	2330.356	18	2334.34	2	Fe II		2334.293	10
2330.49	1					2334.37	3	Fe		2334.321	7
2330.57	1					2334.41	2	Cr II	47	2334.37	UV
2330.68	2h	Cr I?		2330.71	28	2334.44	2	Si II	0.01	2334.404	37
2330.86	2h					2334.51		Vd I	31	2334.434	UV
2331.07	6	Fe II	183	2331.076	UV	to		Fe II		2334.522	10
		Fe I	108	2331.088	29		4W	Fe I	110	2334.524	43
2331.30	7W	Fe II	35	2331.308	UV	2334.59		Cr II	47	2334.58	UV
2331.70	6	Ni I	13	2331.698	UV	2334.67	2	Ni II	20	2334.584	52
2331.77	5					2334.75	1	Si II	0.01	2334.606	37
2331.93	2h					2334.79	1	Fe		2334.726	7
2332.09	2h	Co I		2332.087	UV	2334.84	3	Rh II	27	2334.77	UV
2332.44	2					2335.00	2h	Cr II	47	2334.83	UV
2332.82	9W	Fe II	3	2332.798	UV	2335.08	1h	Fe		2335.024	7
2333.07	5	Co I	15	2333.071	UV	2335.21	5d	Co I	6	2335.102	UV
2333.31	2	Cr I	40	2333.33	UV	2335.45	1h	Vd II	55	2335.480	UV
		Vd I	31	2333.33	UV	2335.57	3	Fe II		2335.570	10
2333.44	4	Cr II	47	2333.46	UV	2335.68	2	Fe		2335.702	7
2333.61	2					2335.75	3	Fe II		2335.757	10
2333.69	2h	Fe II		2333.707	23	2335.99	4	Co I	11	2335.98	UV
2333.83	2d	Cr II	47	2333.84	UV	2336.07	1	Fe I	12	2336.054	43
		Cr II	47	2333.87	UV			Vd II?	57	2336.098	UV

## The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2336.22	4	Co II	8	2336.230	18	2340.02	4	Fe I	12	2340.020	43
2336.34	2					2340.14	1				
2336.42	2					2340.25	4	Fe I?		2340.26	51
2336.50	2	Fe I		2336.512	43	2340.35	2	Fe II	344	2340.352	23
2336.62	3w	-Ni II	27	2336.625	52	2340.45	4d	Fe II Vd I	166 31	2340.459 2340.479	UV UV
2336.71	3	Ni II	50	2336.712	52	2340.59	1	Fe II		2340.561	23
2336.84	3h	Fe II		2336.828	10	2340.69	4	Fe II?—		2340.688	38
2336.97	2	Co II		2336.999	18	2340.77	3				
2337.09	4	Ni I	29	2337.087	UV	2340.93	4	Fe II	166	2340.939	UV
2337.20	3					2341.00	3	Co I	62	2340.99	50
2337.30	2W					2341.12	4	Co II		2341.120	18
2337.48	7	Ni I	8	2337.484	UV	2341.19	4	Cr I   Ni II	40 50	2341.17 2341.202	UV 52
2337.81	7	Fe II   Ni I	32	2337.789 2337.814	10 UV	2341.36	3	Fe I		2341.373	29
2338.00	9W	Fe II	3	2338.005	UV	2341.43	1	Fe II		2341.444	23
2338.49	5	Ni I	30	2338.493	UV	2341.56	5	Fe I	13	2341.575	UV
2338.66	5	Co I	11	2338.656	UV	2341.71	1	Fe II		2341.676	10
2338.83	3					2341.78	1	Co I		2341.784	50
2339.05	4	Co I	12	2339.048	UV	2341.87	1				
2339.25	1	Cr I	40	2339.27	UV	2341.94	4	Fe II	314	2341.953	23
2339.34	3					2342.06	1w				
2339.40	4	Fe II	105	2339.408	UV	2342.13	2	Vd II	55	2342.142	UV
2339.50	3	Fe I		2339.508	7	2342.25	6	Fe II	104	2342.238	UV
2339.64	4d	Fe Vd I	31	2339.645 2339.673	7 UV	2342.52	3	Fe I		2342.510	43
2339.75	2	Fe II		2339.748	10	2342.56	2	Fe I		2342.551	43
2339.84	3h	Fe II		2339.862	10						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2342.79	3	Co I	15	2342.793	50	2346.50	3	Fe II	379	2346.508	UV
2343.13	2					2346.57	4	Co II		2346.563	18
2343.29	2	Fe		2343.307	7	2346.63	6	Ni I	12	2346.628	UV
2343.50	9W	Fe II	3	2343.495	UV	2346.74	4				
2343.74	5					2346.86	1	Vd II	54	2346.868	UV
2343.97	5W	Fe II	35	2343.958	UV	2347.02	4	-Vd I	31	2347.026	UV
2344.28	6W	Co II  Fe II	8 3	2344.276 2344.278	18 UV	2347.08	4				
2344.62	2h	Fe Co II		2344.602 2344.628	7 18	2347.14	2	Fe II		2347.138	23
2344.70	3h					2347.39	5	Co II	8	2347.396	18
2344.98	4	Fe II		2344.984	7	2347.46	4	Ti II	18	2347.46	UV
2345.02	6	Fe I		2345.018	29	2347.58	4	Ba II	2	2347.592	UV
2345.18	2	Fe II	287	2345.177	UV	2347.77	2	Fe Co II		2347.778 2347.804	7 18
2345.26	4	Cr II  Ni II	34 58	2345.25 2345.267	UV 52	2347.88	4				
2345.34	5d	Fe II Cr II	165 34	2345.327 2345.35	UV UV	2348.13	7W	Fe II	36	2348.118	UV
2345.46	5d	Ni II— Fe I	11 13	2345.442 2345.489	52 43	2348.31	8W	Fe II	3	2348.300	UV
2345.55	7w	Ni I	6	2345.539	UV	2348.48	3	Ti II		2348.40	38
2345.76	2					2348.61	4h	Be I	1	2348.610‡	22
2345.84	4					2348.73	4d	Ni I—	32	2348.734	UV
2345.95	5	Fe II		2345.964	38	2348.92	2	Cr I	40	2348.92	UV
2346.07	5	Ni I		2346.074	UV	2349.02	1				
2346.17	4	Co I	12	2346.161	UV	2349.14	4				
2346.29	6	Fe II	314	2346.271	UV	2349.34	3				
		Fe II	379	2346.271	UV	2349.47	2				
2346.38	4	Ti II	18	2346.362	56						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2349.62	4					2352.39	2	Fe I?		2352.39	51
2349.69	2					2352.45	3h	Ti II?		2352.47	38
2349.83	2	As I	6	2349.84	UV	2352.54	1				
2349.94	4d	Ti II	18	2349.944	56	2352.60	3	Au I	5	2352.58	UV
2350.04	1					2352.68	2				
2350.17	4d	Si II Fe II	0.01 379	2350.174 2350.186	UV	2352.87	4	Co I	60	2352.864	UV
2350.28	3	Co I	63	2350.284	UV	2352.94	4	Mn I-	35	2352.937	UV
2350.42	5d	Cr I Fe I Fe I	40 11 69	2350.40 2350.411 2350.411	UV	2353.04	2	Zr II	16	2353.21	UV
2350.62	4d	Co I Fe I Ti II		2350.596 2350.626 2350.640	50 29 56	2353.31	3				
2350.84	4d	Be I Ni II?	19	2350.829 2350.845	22 52	2353.41	5	Co II	8	2353.410	18
2351.00	2					2353.55	4				
2351.18	5w	Fe II	165	2351.198	UV	2353.68	4w	Fe II	379	2353.682	UV
2351.37	4	Co I	13	2351.385	UV	2353.80	3w				
2351.52	2h					2353.84	2				
2351.62	2	Fe		2351.607	7	2354.09	4d				
2351.67	3	Fe II	379	2351.672	UV	2354.30	2	Cr I	40	2354.30	UV
2351.88	5W	Fe I Fe I	12	2351.884 2351.884	29 29	2354.51	6W	Fe II	165	2354.473	UV
2351.97	2	Fe II		2351.958	23	2354.88	6W	Fe II	35	2354.884	UV
2352.04	1					2355.06	5	Ni I	31	2355.050	UV
2352.18	2	IVd II Co II?	55	2352.177 2352.202	UV 18	2355.15	2	Ti II	18	2355.147	56
2352.26	3					2355.21	4	Fe II	165	2355.218	UV
2352.30	3	Fe II	379	2352.315	UV	2355.33	3	Fe I Fe II	11 379	2355.334 2355.351	7 UV

The Echelle Solar Spectrum (Continued)

Solar			Laboratory				Solar			Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref		
2355.41	1	C I	61.01	2355.445	37	2357.81	3	Vd II	187	2357.810	UV		
2355.48	4	Co I	11	2355.480	UV	2357.93	3	Ti II	18	2357.828	56		
2355.61	2h	Co I	63	2355.611	UV	2358.18	5	Ru II	42	2357.92	UV		
2355.70	2					2358.43	1h	Co I	11	2358.177	UV		
						2358.43		Co II		2358.203	18		
2355.73	3					2358.52	1h	Mn II	38	2358.448	19		
2355.76	3					2358.52	1h	Fe II		2358.516	10		
2355.83	1	Ti II	18	2355.86	UV	2358.62	4	Fe I		2358.622	29		
2355.91	3	Fe I	12	2355.915	UV	2358.68	2	Co I	6	2358.676	UV		
2356.09	1					2358.85	5	Ni I	29	2358.853	UV		
2356.19	4	Fe II		2356.185	10	2359.10	8W	Fe II	3	2359.111	UV		
		Fe I		2356.196	29			Fe II	165	2359.111	UV		
								Fe II	379	2359.111	UV		
2356.28	4h	Co I	10	2356.267	UV	2359.37	2						
2356.41	5	Ni II	22	2356.403	52	2359.44	2	Mn II?	38	2359.47	19		
2356.58	5					2359.57	5	Fe II	165	2359.594	UV		
2356.69	1					2359.86	3h						
2356.87	5	Ni I	30	2356.864	UV	2360.01	7W	Fe II	35	2359.999	UV		
2356.95	1					2360.29	7W	Fe II	36	2360.287	UV		
2357.01	3d	Fe II	333	2357.005	UV	2360.41	2	Fe		2360.411	7		
		Fe II	379	2357.005	UV								
2357.12	3					2360.52	3h	Co II		2360.506	18		
2357.16	1					2360.62	4	Fe II		2360.514	23		
2357.29	2d					2360.75	4	Ni I	10	2360.633	UV		
2357.39	1h					2360.87	3	Fe I		2360.755	29		
2357.52	5d	Co I-	114	2357.507	UV	2361.03	2	Fe		2361.009	7		
2357.64	1					2361.09	3	Fe II		2361.072	10		
2357.71	3	Fe I		2357.712	43	2361.36	2h	Fe II	270	2361.371	UV		
2357.77	3												

The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2361.51	4	Co II	8	2361.517	18	2363.99	3d	-Cr II	10	2364.02	UV
2361.57	3					2364.29	1				
2361.72	4w	Fe II	165	2361.728	UV	2364.43	2h	Fe I		2364.436	43
		Fe II	379	2361.728	UV	2364.84	8W	Fe II	3	2364.825	UV
2361.75	1	Mn II	38	2361.768	19	2365.05	5	Co I	6	2365.057	UV
2361.87	2					2365.25	1	Cr II	111	2365.26	UV
2361.92	3	Fe I		2361.936	29	2365.25		Cr II	203	2365.26	UV
2361.96	3					2365.40	1h				
2362.00	5	Fe II	35	2362.014	UV	2365.51	4	Fe I	107	2365.509	UV
2362.06	5	Ni I	5	2362.070	UV	2365.66	4	Ni I	8	2365.657	UV
2362.09	4	Fe II	117	2362.118	38	2365.77	3	Fe II		2365.771	23
2362.19	2	Cr I	40	2362.19	UV	2365.92	4	Cr I	1	2365.91	UV
2362.33	2	Co I	62	2362.327	UV	2366.04	4d	Fe II	287	2366.040	UV
2362.50	2					2366.04		Co I		2366.046	50
						2366.04		Fe II		2366.065	38
2362.56	2					2366.14	3	Cr I	40	2366.14	UV
2362.61	3	Fe I		2362.624	29	2366.21	3				
2362.77	1					2366.31	3	Cr I	39	2366.31	UV
2362.86	2					2366.38	3				
2363.06	1					2366.51	3	Vd II? -  Ni II	25 36	2366.490 2366.542	UV 52
2363.12	2	Fe II		2363.115	10	2366.60	5W	Fe II	35	2366.591	UV
2363.14	3					2366.70	3				
2363.37	3					2366.75	3	Cr II?	34	2366.75	UV
2363.41	4	Fe II		2363.403	10	2366.82	4	Cr I	1	2366.81	UV
2363.64	4w	Fe II	165	2363.641	UV	2366.82		Cr II	34	2366.84	UV
2363.77	4	Co II	8	2363.796	18	2366.86	4	Cr II	34	2366.84	UV
2363.81	5	Fe II	270	2363.811	UV	2366.90	2	Fe II	2	2366.864	UV
2363.86	4d	Fe II	379	2363.855	UV	2366.90		Vd II	43	2366.883	UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2367.05	6w	Al I	4	2367.053	14	2370.52	6W	Fe II	35	2370.494	UV
2367.19	2	Co II?		2367.205	18	2370.62	4	Co I	8	2370.514	UV
2367.33	3					2370.74	3	Fe II	182	2370.612	38
2367.40	5	Ni II	11	2367.385	52	2370.82	2	Co II		2370.720	18
2367.61	3	Al I	11	2367.611	14	2370.94	1	Al I	11	2370.726	14
2367.71	3					2371.07	1	Fe		2370.774	7
2367.81	4	Ni I		2367.803	38	2371.14	3			2370.808	43
2367.87	2	Cr I	10	2367.86	UV	2371.21	3			2370.951	23
2368.13	3	Al I	11	2368.112	14	2371.38	3	Fe II			
2368.49	3	Cr I	39	2368.49	UV	2371.44	6	Fe I	11	2371.357	38
2368.60	7W	Fe II	36	2368.593	UV	2371.63	1W	Co I	133	2371.430	7
2368.89	3	Fe I		2368.884	43	2371.74	2	Fe II		2371.458	UV
2369.24	4	Ni II	36	2369.218	52	2371.86	4	Fe II		2371.706	10
		Fe II	182	2369.232	UV	2371.97	2	Co I	12	2371.845	UV
2369.30	3	Ti I	13	2369.283	58	2372.08	5w	Al I	3	2372.070	14
		Al I	11	2369.304	14	2372.28	3	Al I	11	2372.070	14
2369.46	5	Fe I	11	2369.456	7	2372.36	3	Ti I	12	2372.254	58
2369.68	4	Co I	60	2369.674	UV	2372.55	2W	Al I	3	2372.584	UV
2369.75	4	Fe		2369.727	7	2372.64	3	Al I	11	2372.631	UV
		Fe II		2369.740	10	2372.74	1	Ti I	12	2372.361	10
2369.90	2	Cu II	51	2369.890	25	2372.81	3	Fe II		2372.774	UV
2369.94	4	Co I	62	2369.924	UV	2372.86	3	Fe II	333	2372.832	UV
		Fe II	379	2369.960	UV	2373.13	6w	Co I	9	2372.88	UV
2370.04	4h	Fe I	67	2370.031	43			Cr I	39	2373.122	14
2370.23	2	Al I	11	2370.225	14			Al I	4		
2370.37	3	Cr I	39	2370.37	UV						

The Echelle Solar Spectrum (Continued)

Solar			Laboratory				Solar			Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref		
2373.36	5w	Al I	4	2373.351	14	2376.51	3						
2373.58	2	Al I	11	2373.571	14	2376.64	2						
2373.63	6	Fe I	11	2373.624	7	2376.69	1						
2373.69	3	Cr I	39	2373.69	UV	2376.76	3	Fe II		2376.737	23		
2373.75	8W	Fe II	2	2373.733	UV	2376.91	1						
2373.88	2	Co I	13	2373.862	UV	2376.98	4	Fe I		2376.971	29		
2374.21	1					2377.05	1	Co I		2376.975	50		
2374.45	2d	Zr I— Co I	15	2374.43	UV	2377.21	3	Mn I		2377.183	UV		
			13	2374.456	50	2377.25	5	Co I— Fe I?		2377.215	UV		
2374.52	5	Al I	11	2374.496	14					2377.24	51		
		Fe I	11	2374.518	7			Pt II		2377.276	UV		
2374.58	2	Ti I	13	2374.591	58	2377.40	3	Fe II		2377.426	10		
2374.71	1					2377.51	2w						
2374.88	3	Fe II		2374.870	23	2377.76	1						
2375.20	7W	Co II	8	2375.189	18	2377.82	3						
		Fe II	36	2375.192	UV								
2375.44	5w	Ni II	21	2375.418	52	2377.88	5	Fe I		2377.891	7		
2375.66	2	Fe I		2375.678	29	2377.98	5	Fe I	107	2377.991	UV		
2375.88	3	Fe I		2375.880	43	2378.12	3w	Fe II		2378.135	10		
2375.97	2	Fe I		2375.990	29	2378.28	3	Ti I	12	2378.145	58		
2376.02	5	Ni II	11	2376.010	52	2378.39	5	Al I	3	2378.395	14		
		Ni I	30	2376.016	UV								
2376.13	2					2378.52	5	Fe II	270	2378.526	UV		
2376.20	1							Fe II	377	2378.526	UV		
2376.30	3	Fe I	4	2376.276	29	2378.64	6d	Fe I		2378.604	29		
		Au I		2376.28	UV			Co II	7	2378.622	18		
2376.37	3					2378.80	1	Fe		2378.820	7		
2376.42	5	Fe II	379	2376.435	UV	2378.92	3	Co I	125	2378.905	UV		
						2379.00	4	Fe II	182	2379.003	UV		

The Echelle Solar Spectrum (Continued)

Solar			Laboratory				Solar			Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref		
2379.14	5	Ge I Vd II I Fe II I Co I	9 43 211 12	2379.144 2379.149 2379.155 2379.160	25 UV UV UV	2383.26	6w	II Fe II Cr I	36 39	2383.242 2383.303	UV UV		
2379.28	7W	Fe II	36	2379.275	UV	2383.78	3W	Fe I		2383.790	29		
2379.40	2	Fe II		2379.392	23	2383.98	2	Vd II	25	2383.995	UV		
2379.46	2					2384.04	4	Mn I	2	2384.049	UV		
2379.56	3	Cr I	38	2379.56	UV	2384.39	6W	II Fe II Ni I	36 10	2384.386 2384.390	UV UV		
2379.71	3	Ni I	55	2379.720	UV	2384.85	4	Co I	5	2384.858	UV		
2379.81	4	-Cr I	39	2379.85	UV	2384.98		Fe II	35	2384.999	UV		
2379.94	2	Cr I	10	2379.95	UV	2385.01	4W	Ni I		2385.011	UV		
2380.01	2d	-Fe II?		2380.028	38	2385.05		Fe I		2385.038	43		
2380.26	1	Fe I		2380.284	43	2385.32	1						
2380.34	3	Fe I		2380.345	43	2385.38	3h	Fe I		2385.386	29		
2380.47	4	Cr I I Co I Co I	10 6 61	2380.46 2380.483 2380.483	UV UV UV	2385.43	1						
2380.76	8W	Fe II	3	2380.757	UV	2385.57	3	Fe I		2385.580	29		
2381.37?	1	Cr I?	70	2381.36	UV	2385.71	2	Cr I	39	2385.72	UV		
2381.45?	1	Cr II Cr II	34 34	2381.48 2381.48	UV UV	2385.78	3	Co I		2385.813	UV		
2381.63	1	Fe I		2381.611	43	2386.07	1h	Fe I	69	2385.916	43		
2381.80	8	Co II- Fe I	11	2381.763 2381.835	18 7	2386.20	3w	Cr I	38	2386.18	UV		
2382.03	9W	Fe II	2	2382.034‡	UV	2386.36	6	Co II Fe II	7 396	2386.370 2386.387	18 10		
2382.22	5w	Fe II-		2382.215	38	2386.46	2						
2382.37	2	Fe II	35	2382.356	UV	2386.58	6	Ni I	32	2386.585	UV		
2382.90	5w	Fe II	117	2382.902	UV	2386.72	3	Co II		2386.716	18		
2383.05	6w	Fe II	2	2383.060	UV	2386.77	1	Cr I	36	2386.77	UV		

The Echelle Solar Spectrum (Continued)

Solar			Laboratory				Solar			Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref		
2386.99	2h	Mn II?	48	2387.004	19	2389.86	3	Fe II	244	2389.870	UV		
2387.11	3h					2389.97	5h	Fe I	11	2389.973	7		
2387.28	4	Fe I		2387.278	51	2390.07	2	Fe II		2390.104	23		
2387.36	2	Fe II		2387.380	23	2390.19	1						
2387.43	3h	Fe II—Co I	286	2387.424 2387.460	UV 50	2390.28	3	Fe II	304	2390.311	UV		
2387.54	4	Ni I	54	2387.549	UV	2390.42	2	Co I		2390.426	UV		
2387.58	1					2390.52	2w	Fe I		2390.523	43		
2387.69	3					2390.57	3	Fe II	304	2390.546	UV		
2387.76	4	Au I INi II	4 19	2387.75 2387.764	UV 52	2390.74	2	Fe II	402	2390.766	UV		
2387.82	3	Fe I	67	2387.830	29	2391.07	4	Fe II?	388	2391.043	38		
2387.88	1	Fe I?	69	2387.913	43	2391.11	2	Fe I?		2391.131	43		
2387.95	3					2391.30	2						
2388.08	3	Fe I		2388.090	29	2391.37	3	Co I		2391.369	UV		
2388.21	3d	Co I Fe II	59 148	2388.175 2388.230	UV UV	2391.48	5W	Fe II	35	2391.475	UV		
2388.38	2	Co I Fe II	10 117	2388.374 2388.387	UV UV	2391.82	4	Fe I		2391.826	29		
2388.65	8W	Fe II	2	2388.629	UV	2392.02	5	Co I	6	2392.029	UV		
2388.94	7	Co II	7	2388.915	18	2392.09	3	Ni II	36	2392.106	52		
2389.23	2h	Fe II		2389.263	10	2392.23	2						
2389.40	3					2392.34	2h	Cr I	36	2392.34	UV		
2389.44	2	Cr I Fe II	36	2389.43 2389.431	UV 23	2392.52	1						
2389.52	5	Co II	7	2389.540	18	2392.59	4	Co II— INi II	36	2392.568 2392.588	18 52		
2389.68	3D	Vd II	25	2389.696	UV	2392.64	4	Cu I	19	2392.630	32		
2389.73		Cr II	146	2389.75	UV								

The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2392.86	3	Cr I	36	2392.86	UV	2396.09	3w	Fe II		2396.086	10
2392.95	5	Ni I	31	2392.961	UV	2396.22	1	Co I	132	2396.232	UV
2393.01	2					2396.38	4	Cr I	36	2396.36	UV
2393.11	4	Fe I Ni I	66 31	2393.094 2393.109	29 UV	2396.64	4	!Ni I	12	2396.378	UV
2393.17	2					2396.72	4	Ru II	41	2396.71	UV
2393.46	2h	Fe II		2393.453	10	2396.76	2h	Fe II	211	2396.714	UV
2393.56	1					2397.05	3w	Co I		2396.779	UV
2393.71	3					2397.05		Co I		2397.03	50
2393.89	4	Co II	8	2393.901	18	2397.18	2	Fe I	67	2397.058	43
2393.99	2	Fe II Cr II	146	2393.989 2393.99	23 UV	2397.26	1	Co I		2397.25	50
2394.05	3	Fe I		2394.058	29	2397.38	4	Co II	16	2397.389	18
2394.17	1	Fe II	303	2394.172	23	2397.54	2				
2394.22	1	Co I		2394.227	50	2397.75	3	Cr II	43	2397.75	UV
2394.29	4	Fe I		2394.303	29	2397.82	2	Fe II		2397.828	23
2394.40	3					2397.99	2h				
2394.51	5W	Ni II	20	2394.519	52	2398.07	1w				
2394.63	1					2398.23	3	Fe I	106	2398.215	UV
2394.71	2	Fe I		2394.699	43	2398.35	2				
2394.82	4D	Ni II	36	2394.843	52	2398.39	2	Co II		2398.380	18
2394.88		Fe II	116	2394.892	UV	2398.56	5	Ca I		2398.559	45
2394.97	3w	Ni I	30	2394.989	38	2398.65	1	Fe II	402	2398.664	UV
2395.18	2	Fe I		2395.186	29	2398.70	2	Fe I	107	2398.726	29
2395.42	6W	Fe II	2	2395.416	UV	2398.90	1w				
2395.62	9W	Fe II	2	2395.627	UV	2399.25	8W	!Fe II	2	2399.237	UV
								Fe II	36	2399.237	UV

The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2399.64	1	Fe II Cr II	303 235	2399.636 2399.67	23 UV	2402.26	3	Fe II Fe II	181	2402.255 2402.255	UV 23
2399.72	1					2402.42					
2399.99						2402.46		Fe II	377	2402.450	UV
2400.02	3D					2402.54	3	Fe I— Co I	61	2402.522 2402.559	43 UV
2400.05		Fe II		2400.059	23	2402.59	4w	Fe II	36	2402.597	UV
2400.27	3w	Cr II Fe II	170 181	2400.24 2400.274	UV UV	2402.75	2h	Ru II	41	2402.72 ‡	UV
2400.34	4	Fe II	244	2400.338	UV	2402.95	3	Fe I		2402.938	29
2400.41	2					2403.11	2H	Pt I—	8	2403.10	UV
2400.55	2	Co I	115	2400.558	UV	2403.35	2H	Cu II Co I	76	2403.337 2403.337	25 50
2400.64	3					2403.54	3	Fe I		2403.542	29
2400.84	2	Co I	60	2400.833	UV	2404.19	5	Co II	7	2404.167	18
2400.98	3					2404.45	5W	Fe II	2	2404.430	UV
2401.10	4D	Co I		2401.102	50	2404.93	9W	Fe II	2	2404.882	UV
2401.14		Fe I		2401.136	29	2405.32	1h	Fe I		2405.302	29
2401.19	1					2405.69	1	Fe II	402	2405.688	UV
2401.29	3	Fe II	402	2401.301	UV	2406.10	3h	Fe II	131	2406.086	UV
2401.42	1h					2406.24	2	Co I	58	2406.266	UV
2401.50	3h	Fe I?		2401.52	51	2406.66	8W	Fe II	2	2406.660	UV
2401.60	3	Co I	10	2401.595	UV	2406.88	3	Ni II	36	2406.875	52
2401.78	2					2406.98	4	Fe II	302	2406.982	UV
2401.85	5	Ni I	6	2401.839	UV	2407.24	5	Co I	6	2407.249	UV
2401.98	1					2407.58	2	Fe I?		2407.60	51
2402.07	4D	Co I	5	2402.058	UV	2407.66	3	Co II		2407.655	18
2402.12		Fe II Fe I		2402.079 2402.109	23 29	2407.76	3	Fe II	396	2407.765	UV
2402.17	2	Co I	12	2402.164	UV						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2407.93	3h	Fe II	116	2407.940	UV	2412.16	3	Fe I		2412.172	29
2408.04	4	Fe I	67	2408.046	7	2412.26	3	Ni II	11	2412.265	52
		Fe I	68	2408.062	7	2412.48	3	Ni I	5	2412.489	38
2408.40	3	Co II		2408.424	18	2412.64	4	Ni I	8	2412.640	UV
2408.53	1					2412.75	4	Co I	10	2412.762	UV
2408.61	3	Cr I	36	2408.60	UV	2412.89	3	Co I	64	2412.766	29
2408.75	4	Cr I	36	2408.72	UV	2413.03	4	Vd I	23	2412.896	UV
		Co II	7	2408.754	18	2413.31	8W	Fe II	2	2413.308	UV
2408.85	1	Mn II	37	2408.857	19	2413.55	1h	Co I	125	2413.580	UV
2408.92	2h					2413.68	1h			2413.031	UV
2409.03	2					2413.74	3	Fe I		2413.040	52
2409.11	2	Co I		2409.123	50	2413.90	2h			2413.764	29
2409.20	1					2413.97	2	Fe II		2413.998	23
2409.37	4d	-Fe II	150	2409.377	UV	2414.07	5d	Co II		2414.071	18
						2414.46	5	Fe II	164	2414.080	UV
2409.47	2					2414.33	3	Fe I	68	2414.318	29
2409.58	2					2414.94	3	Co I	6	2414.458	UV
2409.70	3d	Fe II	224	2409.708	UV	2415.06		Fe II	181	2415.068	UV
2409.95	1H	Fe I?		2409.975	43	2415.10					
2410.55	8W	Fe II	2	2410.521	UV	2415.14					
2411.08	8W	Fe II	2	2411.062	UV	2415.29	5	Co I	6	2415.29	UV
2411.33	1	Ti I	11	2411.358	58	2415.51	1	Co I	5	2415.32	UV
2411.55	4	Fe I		2411.558	29	2415.68	4	SiO	(0-1)	2415.504	30
		Ti I	11	2411.568	58	2415.79	3w	-SiO	(0-1)	2415.698	30
2411.61	5	Co I	6	2411.618	UV			Fe II	130	2415.776	UV
2411.72	2	Fe I		2411.738	29						
2411.79	1h	Fe II		2411.810	23						
2411.96	4w	Fe I	67	2411.968	29						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2415.99	3	Fe II Co II		2415.967 2415.991	23 18	2418.57	1	SiO	(0-1)	2418.581	30
2416.13	4	Ni II	20	2416.134	52	2418.72	3	Fe II Fe II	364	2418.702 2418.702	UV 23
2416.22	2	Co II Fe I		2416.220 2416.230	18 43	2418.78	4w	Fe I		2418.781	43
2416.36	1w	Mn II SiO	37 (0-1)	2416.347 2416.349	19 30	2418.96	3	SiO?	(0-1)	2418.922	30
2416.43	2	Cr II Fe II	235 396	2416.40 2416.457	UV UV	2419.12	4	Co I		2419.122	UV
2416.60	1	SiO	(0-1)	2416.602	30	2419.26	5	Fe I		2419.236	29
2416.70	3	Fe II	286	2416.705	UV	2419.31	6	Ni I Co I	7	2419.310 2419.324	UV 50
2416.88	4	Co II	16	2416.901	18	2419.40	5w	Zr II ICr II	24 43	2419.37 2419.38	UV 27
2416.94	1					2419.71	3				
2417.04	2	Co I		2417.045	UV	2419.82	1	Co I	59	2419.828	UV
2417.13	1	SiO	(0-1)	2417.116	30	2419.88	5	Fe I	68	2419.878	7
2417.19	2					2419.98		Fe II	180	2419.892	UV
2417.31	3	Co I Vd I	23	2417.329 2417.351	UV UV	2419.94	1	Cr I?	34	2419.98	UV
2417.35	3	Ge I	8	2417.367	25	2420.02	3	Fe II	396	2419.998	UV
2417.48	4	Fe I	105	2417.490	UV	2420.10	3	ICr II Mn I	43 34	2420.11 2420.110	UV UV
2417.65	5	Co II	7	2417.664	18	2420.22	4	Si I	86.01	2420.24	37
2417.80	5D	Fe		2417.821	7	2420.39	4	IFe I Mn I	64 33	2420.396 2420.403	7 4
2417.85		Fe II	244	2417.859	UV	2420.47	2h				
2418.02	3	SiO— Fe?	(0-1)	2417.990 2418.029	30 7	2420.53	4				
2418.16	3	Fe II		2418.146	10	2420.60	4				
2418.37	3h	Ti I	11	2418.362	58	2420.73	4d	Co II		2420.730	18
2418.44	2	Fe II	396	2418.440	UV	2420.94	2	Fe I?		2420.923	51
2418.47	1h	Co II		2418.470	18	2421.00	2				

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2421.09	4h	Vd I I Fe I	23	2421.058 2421.089	UV 43	2424.02	5	Ni I	30	2424.027	UV
2421.22	6	Ni I	6	2421.223	UV	2424.15	6	Fe II	180	2424.141	UV
2421.27	4d	Mn I Mn I- Ti I	34	2421.254 2421.254 2421.296	4 4 58	2424.25	3	ITi I Mn I	11 34	2424.247 2424.260	58 UV
2421.35	1	Fe I		2421.332	43	2424.39	5	Fe II	149	2424.380	UV
2421.72	3W	Cr I?		2421.71	28	2424.60	5	Fe II Fe II	180 301	2424.585 2424.585	UV UV
2421.82	2W	Fe I	67	2421.836	43	2424.65	4				
2421.92	4	Fe II	116	2421.898	UV	2424.77	3	SiO?—	(0-1)	2424.766	30
2422.21	3	Yt II	2	2422.22	UV	2424.93	6w	Co I	5	2424.932	UV
2422.49	3W					2425.06	3w	Fe I?		2425.048	43
2422.56	4	Co I	123	2422.568	UV	2425.13	2				
2422.68	5	Fe II	301	2422.688	UV	2425.19	2	Cr II	43	2425.21	UV
2422.93	4	Fe II	115	2422.932	UV	2425.32	1	SiO	(0-1)	2425.326	30
2423.02	4					2425.36	5	Fe II	210	2425.362	UV
2423.08	5	Fe I	67	2423.089	7	2425.42	4				
		Fe I	68	2423.106	7						
2423.20	5	Fe II	301	2423.204	UV	2425.58	2	Co I	59	2425.593	UV
2423.33	5	Ni I	5	2423.322	UV	2425.61	2				
2423.38	3	Fe II		2423.357	10	2425.64	3	Cr II	43	2425.66	UV
2423.48	4	Fe II	388	2423.500	UV	2425.68	4	Fe II	224	2425.677	UV
2423.59	6D					2425.81	4	SiO— SiO	(0-1) (0-1)	2425.788 2425.835	30 30
2423.63		Co II Ni I	7 11	2423.625 2423.653	UV 18	2425.92	4	Fe II	130	2425.904	UV
2423.73	1					2426.10	3d	Fe I— Co II		2426.077 2426.122	7 18
2423.81	1	SiO	(0-1)	2423.795	30	2426.32	4	Fe I		2426.313	29
2423.90	3	Fe II	313	2423.919	UV	2426.45	3				

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2426.56	3					2428.87	4	Fe I	157	2428.866	43
2426.68	1	Cr I?	84	2426.66	UV	2428.95	1	Fe II	375	2428.970	UV
2426.77	1					2429.04	4	Fe II	301	2429.034	UV
2426.88	1	SiO	(0-1)	2426.858	30	2429.09	3	Ni I	55	2429.092	UV
2426.91	1	SiO	(0-1)	2426.883	30	2429.14	3	Fe II	385	2429.154	23
2427.00	2	Co I		2426.997	UV	2429.22	3	Co I	7	2429.226	UV
2427.13	1	Fe I		2427.129	43	2429.40	6	Mn I	33	2429.233	4
2427.19	3	Fe II	114	2427.197	UV	2429.46	2	Fe I	148	2429.382	UV
2427.29	2	Fe II		2427.282	23	2429.51	3	Fe II	180	2429.497	UV
2427.39	4	Mn II— SiO	74 (0-1)	2427.379 2427.427	19 30	2429.74	1	SiO— SiO	(0-1) (0-1)	2429.716 2429.744	30 30
2427.67	3					2429.79	2				
2427.72	2	Mn II	74	2427.719	19	2429.82	5	Fe I	68	2429.815	7
2427.83	2					2430.09	6w	Fe II	180	2429.849	10
2427.94	2	Mn II	74	2427.939		2430.19	4	Fe II	301	2430.073	UV
2428.07	5w	Fe II	114	2428.079	UV	2430.38	1w	Fe II	301	2430.184	UV
2428.29	6	Fe II	301	2428.286	UV	2430.46	1	Fe I	157	2430.184	UV
2428.34	5	Co II	7	2428.295	18	2430.58	3				
2428.38	4	—Ti I	11	2428.348	58	2430.86	4	SiO	(0-1)	2430.360	30
2428.45	2	Fe II	300	2428.367	UV	2430.90	3	Fe I	33	2430.361	43
2428.54	3	Mn I— Fe	34	2428.423	UV	2431.01	5	Mn I	33	2430.395	4
2428.58	4	SiO	(0-1)	2428.546	30						
2428.66	1	SiO	(0-1)	2428.546	30						
2428.66	1	Fe		2428.596	50						
2428.80	5	Fe II	301	2428.641	7	2431.23	1	Fe II?		2431.000	23
				2428.795	UV			Fe I		2431.025	7
								Fe II	375	2431.236	UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2431.29	4	Fe I?		2431.305	51	2434.07	2	Fe II	375	2434.052	UV
2431.55	3H	Mn I	34	2431.520	UV			Ti I	11	2434.067	58
		SiO	(0-1)	2431.557	30			Mn I	33	2434.071	4
		Ni II	49	2431.561	52	2434.23	3	Mn I	33	2434.208	4
2431.78	3W	Ti I?		2431.772	58	2434.31	3	Fe I		2434.229	UV
2432.21		Co I	5	2432.213	UV	2434.41	4	Fe II	301	2434.299	43
	6D	Ni I		2432.22	48			Ni I	53	2434.398	UV
2432.24		Fe II	180	2432.259	UV	2434.49	2			2434.412	UV
2432.32	3	Fe I	106	2432.332	29	2434.64	3	Fe II	301	2434.645	UV
2432.40	2	Fe I	64	2432.402	29	2434.68	4				
2432.51	3w	Co II		2432.530	18	2434.72	5	Fe II	321	2434.733	23
2432.59	1					2434.82	1	Fe II	375	2434.822	UV
2432.69	3	Fe II	321	2432.701	23	2434.93	4	Fe II	180	2434.94?	UV
2432.78	2					2434.98	3	Fe II	383	2434.988	UV
2432.84	1	SiO	(0-1)	2432.850	30	2435.15	7W	Si I	45	2435.154	37
2432.87	5	Fe II	321	2432.867	23	2435.34	1w	Fe I		2435.345	43
2432.98	1	SiO	(0-1)	2432.958	30	2435.51	1w	Mn I	33	2435.511	4
		Vd II	41	2432.976	UV			Vd I	23	2435.518	UV
2433.06	4h	Fe II	384	2433.050	UV	2435.81	4	Fe II	164	2435.816	UV
		Fe I	68	2433.056	29			Co I		2435.823	50
2433.20	3	Cr II	202	2433.20	UV	2435.86	4	Fe I		2435.870	7
		Ti I	10	2433.211	58						
2433.31	2					2436.06	3	Fe I		2436.072	29
2433.42	1					2436.20	4	Fe II	209	2436.222	UV
2433.48	4	Fe II	164	2433.495	23	2436.34	4	Fe I		2436.346	7
2433.54	4d	Ni II	19	2433.556	52	2436.42	2	Fe II	360	2436.413	23
		Fe II	359	2433.571	23			Co I		2436.435	UV
2433.90	3	Fe I		2433.894	43	2436.65	5d	Fe II	384	2436.615	UV
2433.95	2					2436.78	2	Co I	5	2436.663	UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2436.85	3					2440.09	5d	Pt I—Fe I	2	2440.08	UV
2436.98	4	Co II	7	2436.980	18	2440.16	4	Ti II	157	2440.109	7
		Fe II	375	2436.987	UV				21	2440.178	56
		Fe II	375	2437.100	UV	2440.34	3	Fe I		2440.335	29
2437.16	5d	Fe II	210	2437.157	UV	2440.42	4w	Fe II	300	2440.416	UV
2437.20		Fe I		2437.203	7	2440.68	3				
2437.25	4	Fe II	313	2437.256	UV	2440.99	4	Ti I	10	2440.976	58
2437.37	2	Mn II	74	2437.366	19	2441.04	4	Co I	132	2441.040	UV
2437.63	2	Fe II	375	2437.657	23	2441.14	3	Fe II	395	2441.133	UV
2437.84	4	Mn II	74	2437.844	19	2441.42	1				
2437.88	5	Ni II	19	2437.892	52	2441.54	4d	Fe II	210	2441.548	UV
2438.17	4	Fe I	62	2438.182	7	2441.59					
		Mn II	74	2438.187	19						
2438.30	3	Ti I	10	2438.285	58	2441.62	4d	Cu I	1	2441.637	UV
2438.46	2h	Cr II	202	2438.46	UV	2441.65		Ni I	31	2441.665	UV
2438.57	2					2441.81	4	Ni I	31	2441.817	UV
2438.76	5w	Si I	2	2438.767	37	2441.99	1	Zr II	23	2441.97	UV
2439.03	5	Co I	5	2439.038	UV	2442.05	1				
2439.17	3	Fe I	64	2439.170	7	2442.11	1	Fe		2442.130	7
2439.30	5	Fe II	209	2439.301	UV	2442.23	1w				
2439.35	3					2442.57	5W	Fe I	157	2442.567	UV
2439.41	1					2442.64	3	Co II		2442.631	18
2439.50	1	Co I		2439.495	UV	2442.68	1	Ti II	21	2442.690	56
2439.62	5	Fe I		2439.630	7	2442.77	1				
2439.74	5	Fe I	157	2439.744	7	2442.87	2	Co I		2442.888	UV
2439.83	3	Fe I—Fe II	66	2439.803	43	2443.01	3	Fe II		2443.027	10
			375	2439.860	UV	2443.16	1h				

The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2443.37	5w	Si I	2	2443.364	37	2447.31	4	Fe II	299	2447.320	23
2443.54	2	Co I	57	2443.548	UV	2447.57	2	Fe II	299	2447.560	23
2443.78	4	Co II	16	2443.770	18	2447.71	6w	!Fe I Fe II	9 320	2447.709 2447.753	7 UV
2443.87	5	Fe II Fe I	375 63	2443.842 2443.872	UV 7	2447.83	2h	Co II Fe I?		2447.831 2447.850	18 43
2444.11	3					2448.29	3				
2444.29	2	Fe II	375	2444.274	UV	2448.39	4w	Fe I		2448.388	51
2444.52	5w	Fe II	148	2444.515	UV	2448.57	3	Fe I		2448.570	29
2444.71	2					2448.72	2d	-Fe II	222	2448.731	UV
2444.75	3					2448.84	4	Fe I		2448.826	29
2444.89	3	Fe I		2444.905	29	2448.98	1				
2444.99	1	Vd II	92	2444.967	UV	2449.04	3				
2445.10	4	Fe II	375	2445.108	23	2449.16	5	Co II Fe II	7 129	2449.158 2449.185	18 UV
2445.21	4	Fe I	63	2445.212	7	2449.28	3	Fe II	128	2449.272	UV
2445.34	1					2449.54	1				
2445.59	5w	Fe II	148	2445.569	UV	2449.61	3d	Mg II Cr II	5 190	2449.590 2449.63	44 UV
2445.80	4	Fe II	300	2445.787	UV	2449.72	4h	Fe II	34	2449.739	UV
2446.02	3	Co II		2446.035	18	2449.83	2	Zr II	23	2449.83	UV
2446.11	4	!Fe II Ti I	300 10	2446.103 2446.126	UV 58	2449.98	5d	Cr II Fe II Co II	190 300 16	2449.95 2449.961 2450.001	UV UV 18
2446.22	3	Fe II	209	2446.203	UV	2450.15	1	Fe II	375	2450.134	UV
2446.43	4	Fe II	375	2446.405	UV	2450.20	4	Fe II	300	2450.196	UV
2446.49	5w	Fe II	164	2446.462	UV	2450.44	5	Ti II Fe I Ni I	21 57	2450.44 2450.444 2450.465	UV 7 UV
2446.72	1H	Vd II	41	2446.697	UV	2450.44					
2446.93	2W	Cr II-	190	2446.91	UV						
2447.20	4	Fe II	300	2447.203	UV						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2450.55	2	Fe I		2450.556	43	2453.95		Fe II	375	2453.935	UV
2450.60	1	Vd II?	92	2450.619	UV	2453.98	4w	Fe II	401	2453.973	UV
2450.76	1w	Vd II	41	2450.734	UV	2454.09	2	Ni I	6	2453.984	UV
2450.97	4	Ni I		2450.975	UV	2454.16	2d	Cr II	74	2454.06	UV
2451.10	4	Fe II	34	2451.106	UV	2454.40	2	Fe II	222	2454.158	UV
2451.23	5	Fe II	209	2451.208	UV	2454.58	4	Fe I		2454.399	29
2451.38	5	Fe II	114	2451.354	UV	2454.72	1h	Fe II	320	2454.574	UV
		Fe II	300	2451.354	UV						
		Fe I		2451.384	29						
2451.68	5	Fe I		2451.675	7	2454.82	2d				
2452.12	6w	Si I	2	2452.118	37	2454.96	1W				
2452.33	3w	Fe I		2452.345	29	2455.12	1				
2452.47	1	Mn II	74	2452.486	19	2455.20	2h				
2452.58	3	Co II		2452.561	18	2455.54	4	Ni II?	18	2455.519	52
		Fe I	157	2452.590	UV	2455.58	5	Ru II	41	2455.53	UV
2452.80	2					2455.72	1	Fe		2455.567	7
2452.84	4					2455.85	2				
2452.94	2d	Fe II	300	2452.916	UV	2455.89	1w	Fe II	395	2455.721	UV
		Fe I		2452.965	29						
2453.13	1w	Mn II	74	2453.133	19	2455.98	1w	Ti II	2	2455.99	38
2453.17	2	Fe II	385	2453.165	23	2456.20	4	Fe		2456.189	7
2453.37	2	Vd II—	92	2453.346	UV	2456.56	3w	Ru II	41	2456.57	UV
		Fe I	64	2453.385	43	2456.64	1	Fe II	320	2456.641	UV
2453.47	4	Fe I	62	2453.476	7	2456.70	3	Fe I	106	2456.704	29
2453.56	3	Fe I	157	2453.568	29	2456.83	3	Fe II	209	2456.816	UV
2453.65	1	Mn II	74	2453.620	19	2457.08	2	Fe II	269	2457.104	UV
2453.73	1	Fe II	375	2453.747	UV	2457.18	1w				
2453.80	3W	Fe II	163	2453.794	UV						

The Echelle Solar Spectrum (Continued)

Solar			Laboratory				Solar			Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref		
2457.44	1h	Zr II Vd II	23 91	2457.43 2457.446	UV UV	2460.43	3d	Cr II— Fe II	168 395	2460.42 2460.453	UV UV		
2457.60	6	Fe I	62	2457.598	7	2460.56	2						
2457.69	1					2460.65	1	Fe II	359	2460.644	23		
2457.80	1h	Fe II Ti I	299 9	2457.785 2457.824	23 58	2460.74	1						
2457.90	1w					2460.80	4	Co I	5	2460.800	UV		
2458.00	1W	Ti I?	9	2458.032	58	2460.90	1	Mn I	32	2460.887	UV		
2458.12	2					2461.01	4d	Mn I	32	2461.011	UV		
	2458.15					2461.05		Fe		2461.059	7		
2458.32	1W	Vd II	39	2458.288	UV	2461.20	2w						
2458.56	5w	Fe I	59	2458.568	7	2461.29 2461.33	5	Fe II	209	2461.282	UV		
2458.70	2						3						
2458.78	4	Fe II	209	2458.782	UV	2461.54	1H						
2458.96	3	Fe II	299	2458.964	23	2461.68	4	Fe II	163	2461.667	UV		
2459.11	3h	Fe II	163	2459.097	UV	2461.77	1						
		Fe II	312	2459.097	UV	2461.86	5	Fe II	209	2461.855	UV		
2459.33	2	Fe II Vd II	382 92	2459.296 2459.358	UV UV	2462.18	7	Fe I	9	2462.181	7		
2459.47	1	Co II		2459.452	18	2462.33	4	Fe II Cr II	395 168	2462.325 2462.35	UV		
2459.61	1W					2462.65	8W	Fe I	9	2462.647	7		
	2459.71	1	Mn I	32	2459.694	4	2462.79	3	Mn I	32	2462.776	UV	
2459.90	2W					2462.97	4h	Fe I Mn I	32	2462.967 2463.005	7 UV		
2460.08	3	Fe I		2460.069	29	2463.29	5	Fe II	208	2463.280	UV		
2460.17	3d	Fe II Co I	401	2460.171 2460.195	UV 50	2463.40	2	Ti II	2	2463.41	38		
2460.25	2	Fe I	64	2460.258	43	2463.60	3						
	2460.29	4h	Fe I		7	2463.63	4						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2463.73	5	Fe II	129	2463.726	UV	2466.69	5D	Fe II-	179	2466.670	UV
		Fe II	162	2463.726	UV			Fe II	179	2466.811	23
		Fe I	65	2463.730	7	2466.82	5d				
2463.78	3	Co I	7	2463.776	UV	2466.89	2	Fe I	61	2466.898	43
2463.89	3	Fe II	385	2463.908	23	2466.96	3	Ni I	56	2466.960	UV
2464.01	5	Fe II	208	2464.007	UV	2467.04	1h	Co II		2467.047	18
2464.19	5	Co II	15	2464.201	18	2467.16	2h	Cr I	33	2467.14	UV
2464.35	2	Fe I		2464.349	29	2467.28	2w				
2464.45	1w					2467.43	3W	Pt I	1	2467.42	UV
2464.65	4d	Co I-	7	2464.615	UV	2467.57	5	Fe I		2467.567	7
2464.75	1					2467.72	6w	Co I	5	2467.685	UV
2464.90	5	Fe II	208	2464.903	UV			Fe I	62	2467.732	7
2465.05	2h					2467.99	5h	Fe II		2468.000	10
2465.15	6D	Fe I-	62	2465.149	7	2468.18	4	Fe II	332	2468.194	23
2465.20		Fe II	148	2465.194	UV	2468.25	4	Gd II? -		2468.22	49
2465.25	3w	Ni I	8	2465.263	UV	2468.29	6	Fe II	145	2468.292	UV
		Vd II	92	2465.270	UV			Fe II	163	2468.292	UV
2465.38	2w	Zr II-	23	2465.37	UV	2468.37	2	Ti I	9	2468.359	58
2465.49	3	Ti I?		2465.478	58	2468.54	3	Fe II	113	2468.561	UV
2465.56	1					2468.72	2				
2465.80	3W	Cr II-	281	2465.78	UV	2468.87	6W	Fe I	59	2468.880	7
2465.91	5	Fe II	208	2465.911	UV	2468.99	2	Fe I	64	2469.003	43
2466.06	3d	-Fe I		2466.093	29	2469.13	3d	Cr II	92	2469.13	UV
2466.22	1	Mn II	64	2466.214	19			Ti II	2	2469.146	56
		Cr II?	74	2466.22	UV	2469.20	1				
2466.30	4					2469.37	4	Fe II	162	2469.373	UV
2466.38	3	Fe I		2466.348	29	2469.50	5	Mn I	31	2469.407	UV
2466.55	4	Fe I	65	2466.530	29	2469.66	4	Fe II	299	2469.512	23
								Fe I	10	2469.666	29

The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2469.77	2					2472.91	8W	Fe I	9	2472.875	UV
{ 2469.83	1	Fe II	358	2469.823	23			Fe I	9	2472.910	UV
{ 2469.88	2	Fe I?		2469.90	51	2473.15	6	Co I	57	2472.922	UV
2469.94	4					2473.33	5	Ni II	19	2473.148	52
2469.99	1					2473.40	3	Fe I	8	2473.156	7
2470.07	2					2473.90	3w	Fe II	148	2473.314	23
2470.26	5	Co I	57	2470.270	UV	2474.07	2	Co I	5	2473.901	UV
2470.40	5	Fe II	208	2470.406	UV			Fe II		2474.073	10
2470.67	5	Fe II	179	2470.661	UV	2474.19	3	Cr I	32	2474.08	UV
2470.76	4	Fe II	223	2470.752	UV	2474.30	1	Ti II	2	2474.22	UV
2470.82	2w	Cr II	92	2470.81	UV	2474.46	3	Mg II		2474.314	38
2470.96	5	Fe I	63	2470.966	7	2474.56	1	Fe		2474.442	7
		Fe I	63	2470.966	7			Cr I	32	2474.55	UV
		Ti I	9	2470.987	58			Mg II		2474.584	38
2471.27	2w	Fe II	394	2471.276	UV	2474.79	5w	Fe II	208	2474.762	UV
2471.38	3					2474.96	1	Fe I	62	2474.814	7
2471.54	3w					2475.02	4	Mn II?		2474.967	19
2471.65	3w	Fe II	162	2471.674	UV	2475.13	1W	Fe I		2475.019	7
2471.76	1					2475.29	1w	Ir I?	1	2475.122	UV
2472.06	5	Ni I	7	2472.065	UV			Fe II	395	2475.125	UV
		Fe II	162	2472.075	UV	2475.36	1				
2472.24	4	Ni I	7	2472.224	UV	2475.47	3	Vd II	71	2475.451	UV
2472.35	5	Fe I	63	2472.336	7			Fe I		2475.466	29
		Fe I	59	2472.352	7	2475.54	2h	Fe II	395	2475.548	UV
2472.43	5	Fe II	179	2472.426	UV	2475.70	2	Cr II	92	2475.69	UV
2472.61	4	Fe II- Fe	395	2472.610 2472.643	UV	2475.75	3	Fe I		2475.758	29
					7	2475.91	3H				
						2476.03	4	Fe?		2476.031	7

The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2476.26	4	Fe II	163	2476.264	UV	2479.63	4	Fe I	59	2479.630	7
2476.36	1	Fe II	385	2476.392	23	2479.77	7W	Fe I	9	2479.776	7
2476.47	4	Fe II?	386	2476.437	UV	2479.99	1w				
		Fe I		2476.471	7						
2476.65	4D	Co I	56	2476.640	UV	2480.16	6w	Fe II	179	2480.155	UV
		Fe I	62	2476.657	7	2480.38	4	Fe I		2480.393	29
2476.87	4	Fe I	65	2476.865	7	2480.74	4	Fe I		2480.732	29
		Fe I	3	2476.875	UV						
		Cr II	145	2476.90	UV	2481.04	4	Fe II	243	2481.044	UV
2477.03	1h					2481.22	2	Cr I	32	2481.23	UV
2477.23	3	Ti II	2	2477.21	UV	2481.34	1h	Zr II	14	2481.35	UV
2477.30	4D	Fe I?		2477.304	29	2481.48	2h	Ti II	10	2481.49	UV
2477.34		Fe II	162	2477.342	UV	2481.58	4D	Fe II	112	2481.576	UV
2477.49	4	Fe II	113	2477.487	UV	2481.90	3	Fe II	331	2481.576	UV
2477.85	3W					2481.99	2W	Ni I	28	2481.917	38
2478.12	4	Fe II	224	2478.115	UV	2482.12	5	Fe II	161	2482.117	UV
2478.19	5	Fe II	149	2478.206	UV	2482.33	4	Vd II	39	2482.307	UV
2478.31	3	Fe I		2478.300	29			Fe II	358	2482.320	23
2478.45	4	Fe II	161	2478.449	UV	2482.41	3				
2478.56	5W	C I	61	2478.561	37	2482.50	3w	Cr II	92	2482.48	UV
		Fe II	179	2478.568	UV	2482.66	6	Fe II	207	2482.654	UV
2478.69	3	Ti II	2	2478.68	47	2482.76	2	Fe		2482.752	7
2478.77	3	Ti II	2	2478.77	47	2482.80	3				
2478.92	2	Ru II	41	2478.93	UV	2482.87	4	Fe II-	400	2482.869	UV
2479.02	3	Vd II	71	2479.043	UV	2483.06	3	Vd II	71	2483.064	UV
2479.14	1	Cr I	32	2479.14	UV	2483.15	3				
2479.28	3w	Fe II	208	2479.276	UV	2483.28	8W	Fe I	9	2483.271	7
2479.48	5D	Fe I	65	2479.480	7	2483.43	3				
		Vd II	71	2479.518	UV						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2483.53	5	Fe I	62	2483.533	7	2487.37	6d	Fe II- Fe I	385 10	2487.356 2487.370	UV 7
2483.72	3	Fe II	331	2483.721	UV	2487.60	2				
2483.82	2h	Cr II	75	2483.79	UV	2487.76	3				
2484.02	3	Ni I	50	2484.028	UV	2487.85	3				
2484.21	5W	Fe I	9	2484.185	7	2488.14	8W	Fe I	9	2488.143	7
		Ni II	61	2484.204	52						
		Fe II	243	2484.243	UV	2488.44	3h	Co I	7	2488.461	UV
2484.43	2	Fe II	400	2484.442	UV	2488.70	1				
2484.52	4d	Fe I		2484.530	29	2488.94	5	Fe I	164	2488.945	7
2484.57		Fe II	243	2484.553	UV	2489.07	3	Fe II?		2489.074	7
2484.98	3	Fe I	62	2484.999	43	2489.18	2				
2485.06	4	Fe II	34	2485.076	UV	2489.28	2	Cr II	92	2489.28	UV
2485.12	4	Mn I?— Fe		2485.114	4	2489.50	6	Fe II	161	2489.485	UV
				2485.139	7			Ni I	27	2489.507	UV
2485.25	4	Fe		2485.264	7	2489.76	6	Fe I	9	2489.750	7
2485.35	3	Co II	14	2485.362	18	2489.83	6	Fe II	207	2489.826	UV
2485.43	2	Fe I		2485.435	29	2489.90	5	Fe I	65	2489.913	7
2485.74	2					2489.97	3				
2485.82	1h	Cu II	92	2485.792	25	2490.65	7W	Fe I	9	2490.644	7
2485.85	1h					2490.84	5	Fe I— Fe II	179	2490.829 2490.856	43 UV
2485.98	5	Fe I	59	2485.990	7						
2486.12	2	Mn II?		2486.158	19	2491.15	6W	Fe I	9	2491.155	7
2486.29	4	Cr II	92	2486.29	UV	2491.40	4W	Fe II	207	2491.392	UV
2486.36	6	Fe II	208	2486.343	UV	2491.47	4	Fe		2491.466	7
		Fe I	8	2486.373	7	2491.60	2h				
2486.43	4	Co II	15	2486.436	18	2491.66	2w	Fe I		2491.673	7
2486.69	5	Fe I	62	2486.691	7	2491.98	4w	Fe I	163	2491.982	7
2487.07	4	Fe I	62	2487.066	7						

The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2492.14	3	Cu I	1	2492.146	UV	2494.78	4	Fe I		2494.781	7
2492.22	4	Fe I	164	2492.229	7	2494.90	1	Fe II	382	2494.893	UV
2492.35	4W	Fe II	243	2492.341	UV	2495.07	2	Cr I	31	2495.08	UV
2492.46	1W					2495.23	4W	Fe II Fe I	393	2495.233 2495.247	UV 51
2492.56	2	Cr I	31	2492.57	UV	2495.35	2h				
2492.60	3	Cr II	234	2492.62	UV	2495.54	4	Co I	56	2495.551	UV
2492.66	3w	Fe I	63	2492.630	7	2495.71	2				
2492.81	3	Fe I	59	2492.822	29	2495.83	3				
2492.86	2w	Cr II	234	2492.86	UV	2495.86	5	Fe II		2495.860	23
2493.19	6W	Fe II	161	2493.174	UV	2496.06	4W	Fe I?		2495.871	7
		Fe II	207	2493.174	UV					2496.05	51
2493.28	7W	II Fe II Cr II	161 93	2493.269 2493.28	UV 27	2496.20	3				
2493.48	1	Zn I?		2493.455	38	2496.33	4d	Cr I-	31	2496.30	UV
2493.56	1	Vd II	5	2493.576	UV	2496.45	2h	Cr II	145	2496.44	UV
2493.69	3w					2496.53	6	Fe I	59	2496.533	7
2493.78	3	Fe		2493.751	7	2496.73	4	Co I	57	2496.713	UV
2493.89	2w	Fe II	400	2493.880	UV	2496.77	4	Fe		2496.792	7
2494.00	6	Fe I	62	2494.000	7	2496.86	3				
		Fe I	63	2494.000	7	2496.99	4	Fe I	164	2496.991	7
2494.12	5	Fe II	161	2494.111	UV	2497.30	3	Fe II	208	2497.300	UV
2494.25	5	Fe I	57	2494.252	7	2497.48	1	Co II		2497.486	18
2494.35	1w					2497.55	3				
2494.40	2	Mn I	16	2494.391	UV	2497.71	6	Fe II	128	2497.709	UV
2494.50	3	Fe I	61	2494.509	7			Fe II	242	2497.709	UV
2494.66	2h					2497.83	5h	Fe II	175	2497.817	UV
								Fe II	207	2497.817	UV
2494.74	3	Be I Co I	3	2494.728 2494.730	22 50	2497.98	1	Ge I	2	2497.962	25

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2498.04	3					2502.07	2				
2498.12						2502.22	2				
2498.20	4	Fe		2498.203	7	2502.40	4	Fe II	207	2502.388	UV
2498.34	4	Fe II		2498.361	10	2502.50	4	Fe I		2502.491	7
2498.69	3	Fe I		2498.698	29	2502.63	3				
2498.80	6d	Cr II Co II	93	2498.80 2498.823	UV 18	2502.78	2w	Fe II		2502.762	10
2498.89	7W	Fe II Fe I	161 8	2498.897 2498.898	UV 7	2503.03 2503.17	2W 1w	Vd II	21	2503.018	UV
2499.00	4	Mn II	45	2499.003	19	2503.33	5	Fe II	206	2503.323	UV
2499.22	3w	-Vd I?	17	2499.244	UV	2503.49	5	Fe I	164	2503.492	7
2499.28	3w					2503.56	5	Fe II	161	2503.560	UV
2499.43	2w					2503.87	4	Fe II	285	2503.870	UV
2499.63	3					2504.10	2	Fe I		2504.101	29
2499.70	3	Fe I	104	2499.693	29	2504.31	3	Cr I	31	2504.31	UV
2499.84	2	Cr I	31	2499.84	UV	2504.52	4	Co I	55	2504.518	UV
2500.05	1w					2504.63	2	Fe I		2504.635	29
2500.09	1w					2505.02	4	Cr I	69	2505.00	UV
2500.23	4					2505.02	4	Fe I	163	2505.011	7
2500.49	5h	Co I		2500.494	50	2505.22	4w	Fe II	33	2505.217	UV
2500.65	4					2505.37	1				
2500.90	5W	Fe II	357	2500.919	23	2505.47	5w	Fe I		2505.485	7
2501.13	7W	Fe I	7	2501.132	7	2505.63	5	Fe I		2505.627	UV
2501.33	3	Fe II	400	2501.351	UV	2505.85	2	INi II Cr II	48 200	2505.843 2505.86	52 UV
2501.42	3	Fe I	59	2501.422	43	2506.01	2				
2501.48	3	Cr II	73	2501.48	UV	2506.10	4	Ni II IIFe II	61 207	2506.091 2506.091	52 UV
2501.69	6W	Fe I	56	2501.694	7						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2506.19	2	Vd II	21	2506.215	UV	2509.79	2	Fe I?		2509.800	43
2506.28	1	Cu II	92	2506.273	25	2509.87	4	Fe II	363	2509.875	UV
2506.46	3	Fe II	123	2506.429	UV	2510.02	2w				
		Co II	15	2506.462	18	2510.12	2	Fe II	400	2510.121	UV
2506.57	2	Fe I	163	2506.574	7	2510.23	2	Cr II	200	2510.24	UV
2506.91	8W	Si I	1	2506.897	37	2510.30	2				
2507.04	4	Fe II	207	2507.014	UV	2510.39	1	Fe II		2510.394	10
2507.35	3	Cr I	69	2507.32	UV	2510.50	2	Cr I-	29	2510.49	UV
2507.42	2	Fe I?		2507.40	51	2510.54	3	Fe II	112	2510.565	UV
2507.52	2					2510.67	2	Mn II		2510.655	19
2507.60	2h	Mn II	45	2507.598	UV	2510.84	7W	Fe I	7	2510.835	7
		Fe II	363	2507.607	UV						
2507.69	2	Co I	56	2507.678	UV	2510.90	3	IN II	18	2510.871	52
		Fe II	363	2507.695	UV			Ti II	4	2510.903	56
2507.76	2	Fe?		2507.739	7	2511.01	4	Co I	56	2511.019	UV
		Vd I	17	2507.777	UV			Co II		2511.159	18
		Vd I	19	2507.777	UV	2511.17	2				
2507.92	5W	Fe I	59	2507.900	7	2511.37	4	Fe II	33	2511.375	UV
2508.11	3	Cr I	30	2508.11	UV	2511.76	5H	Fe II	161	2511.759	UV
2508.26	2					2511.94	2D	Fe II		2511.910	23
								Vd I	17	2511.940	UV
2508.35	2	Fe II		2508.338	23			Cr I	69	2511.96	UV
2508.49	3					2512.07	2	Co II		2512.062	18
								C II	14	2512.065	37
2508.75	5	Fe I	63	2508.753	7	2512.20	2	Cr II?	167	2512.22	UV
2508.94	4	Fe I	59	2508.948	29	2512.27	5	Fe I	55	2512.275	7
2509.12	5	Fe II	242	2509.117	UV	2512.37	5	Fe I	8	2512.365	7
2509.27	4					2512.52	3	Fe II	343	2512.513	UV
2509.39	4	Fe I		2509.390	29	2512.73	2	Fe II	129	2512.727	UV
2509.62	1					2512.90	2w	Co I	113	2512.900	UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2512.97	3	Fe I		2512.984	43	2517.22	3h	Fe II	207	2517.211	UV
2513.13	3h	Co I?		2513.119	50	2517.42	5	Ti II	4	2517.448	UV
		Fe II	363	2513.155	UV						
2513.32	4	Fe I		2513.328	UV	2517.59	1w	Cr I	29	2517.57	UV
2513.39	1	Fe II	207	2513.372	UV	2517.65	6	Fe I	59	2517.662	7
2513.49	4	Fe		2513.498	7	2517.81	3W	Co I	56	2517.792	UV
2513.61	1h	Cr I	30	2513.62	UV	2518.10	7W	Fe I	7	2518.102	7
2513.75	2	Fe		2513.785	7	2518.32	2				
2513.85	3	Fe I	164	2513.849	7	2518.41	2w				
2514.31	8W	Si I	1	2514.316	37	2518.70	1	Cr I	30	2518.71	UV
2514.38	4	Fe II	285	2514.383	UV	2518.82	4	Fe I		2518.826	7
2514.55	3W	Fe		2514.569	7	2519.04	6	Fe II	268	2519.044	UV
2514.62	1	Ni II	61	2514.627	52	2519.20	8W	Si I	1	2519.202	37
		Vd II	21	2514.633	UV	2519.39	2	Fe II	222	2519.404	UV
2514.71	4	Fe		2514.709	7	2519.50	3	Cr I	31	2519.51	UV
2514.77	2					2519.62	6w	Vd I	17	2519.622	UV
2514.92	4	Fe II	175	2514.912	UV	2519.81	5d	!Fe I	59	2519.629	7
		Fe II	206	2514.912	UV			Ti II	4	2519.818	56
2515.15	1	Vd I	18	2515.145	UV	2520.17	2W	Co II	15	2519.820	18
2515.83	4	Fe I	104	2515.848	UV	2520.27	1W	Cr I?	31	2520.23	UV
2516.10	9	Si I	1	2516.112‡	37	2520.33	1	Fe II	363	2520.267	UV
2516.25	3w	Fe I	57	2516.250	7						
2516.56	4	Fe I	61	2516.570	7	2520.53	2h	Ti I	8	2520.534	58
								Fe II	343	2520.535	UV
2516.71	2	Mn II	45	2516.742	19	2520.66	4	Cr II	108	2520.65	UV
2516.91	2	Cr I	30	2516.92	UV			!Fe II	242	2520.669	UV
2517.12	5	Fe I	56	2517.119	43	2520.75	2	Fe II	175	2520.749	UV
		Fe II	147	2517.124	UV						
		Vd I	19	2517.142	UV	2520.86	3	Fe?		2520.868	7

The Echelle Solar Spectrum (Continued)

Solar			Laboratory				Solar			Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref		
2520.97	4	Fe I		2520.971	7	2525.37	5w	Fe II	159	2525.386	UV		
2521.08	5	Fe II	268	2521.089	UV	2525.51	3w						
2521.36	5	Co I	3	2521.361	UV	2525.60	5	Ti II	4	2525.619	UV		
2521.46	1	Fe II		2521.485	23	2525.72	1						
2521.62	3h					2525.86	3	Fe II	241	2525.858	23		
								Fe II	357	2525.858	23		
2521.76	2	Fe I?		2521.762	43	2525.92	2	Fe II	363	2525.933	UV		
2521.81	3	Fe II	330	2521.810	23	2526.07	4	Fe II	159	2526.071	UV		
2521.91	5	Fe I	58	2521.918	7	2526.21	3	Vd I	17	2526.213	UV		
2522.09	1					2526.29	5	Fe II	145	2526.292	UV		
2522.19	4	Fe II	159	2522.189	UV	2526.40	1	Mg I?		2526.390	38		
2522.49	5w	Fe I	57	2522.480	7	2526.60	1h	Cu II	92	2526.593	25		
2522.63	1h					2526.81	3	Fe II	33	2526.837	UV		
2522.85	8W	Fe I	7	2522.849	7	2527.14	4w	Fe II	159	2527.107	UV		
2523.14	4	Fe		2523.137	7			Cr I	30	2527.11	UV		
2523.33	3	Fe		2523.323	7			Fe I		2527.16	UV		
2523.45	1W	Fe II	363	2523.451	UV	2527.28	2	Fe I		2527.267	7		
2523.66	5	Fe I		2523.662	7	2527.43	7W	Fe I	7	2527.435	7		
2523.93	2d	Cr II	199	2523.93	UV	2527.70	3	Fe II	329	2527.694	UV		
		Vd II	38	2523.953	UV	2527.91	2	Vd II	50	2527.903	UV		
		Vd II	50	2523.953	UV								
2524.11	7W	Si I	1	2524.108	37	2528.04	2	Cr I	29	2528.02	UV		
2524.28	6W	Fe I	7	2524.293	7	2528.16	3	Ni I	51	2528.048	UV		
2524.62	5D	Fe I		2524.602	7	2528.51	7W	Si I	1	2528.509	37		
		Ti II	4	2524.655	UV								
2524.99	6D	Co II	15	2524.974	18	2528.60	5	Co II	14	2528.615	18		
		Fe I		2525.024	7	2528.70	1	Fe II	176	2528.676	UV		
2525.10	3	Fe II	330	2525.114	23	2528.85	3	Vd II	50	2528.833	UV		
2525.28	1W	Ni II	61	2525.296	52	2528.97	3	Co I	3	2528.968	UV		

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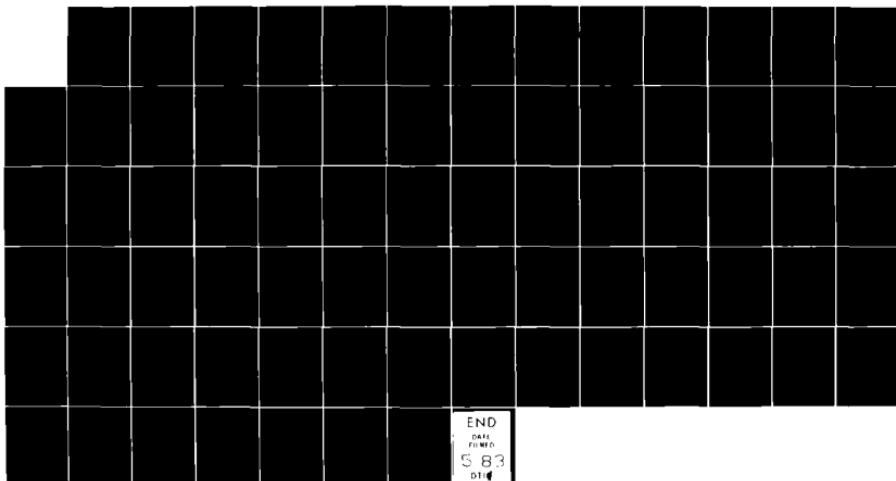
THE SOLAR SPECTRUM 3088A-2095A FROM THE ECHELLE  
SPECTROGRAPH FLOWN IN 1981. (U) NAVAL RESEARCH LAB  
WASHINGTON DC C E MOORE ET AL. 30 DEC 82 NRL-8653

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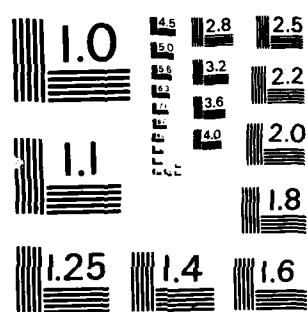
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The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2529.14	6W	Fe II Fe I	357 7	2529.078 2529.135	23 7	2532.07	3	Ni I	27	2532.076	UV
2529.22	3	Fe II	241	2529.221	UV	2532.17	3	Co I	56	2532.176	UV
2529.30	3	Fe I		2529.308	7	2532.27	3	Fe I		2532.269	29
2529.48	1	Cr II	9	2529.48	UV	2532.38	5	Si I	86	2532.381	37
2529.55	4	Fe II Fe II	145 177	2529.545 2529.545	UV UV	2532.46	1	Mg I Zr II	7	2532.463 2532.47	38 UV
2529.73	3	Ti II	4	2529.74	UV	2532.78	1	Mn II	55	2532.781	19
2529.82	5W	Fe I	7	2529.836	7	2532.88	4D	Fe I	56	2532.875	7
2530.11	3	Co II Fe II Fe II Co I	27 178 363 56	2530.094 2530.103 2530.103 2530.134	18	2532.93	3	Mg I		2532.977	38
2530.18	2	Vd I Cr II	19 108	2530.174 2530.18	UV UV	2533.20	3	Fe		2533.140	7
2530.25	2					2533.26	1	Ge I	2	2533.230	25
2530.45	2	Cr I	30	2530.44	UV	2533.32	1	Mn II	55	2533.329	19
2530.54	2	Co I		2530.546	50	2533.45	1	Cr II Mn II	108 55	2533.45 2533.462	UV 19
2530.68	5	Fe I	8	2530.687	7	2533.62	4w	Fe II	159	2533.626	UV
2530.86	1					2533.72	4	Fe Mg I		2533.737 2533.750	7 38
2531.08	3	Fe II	33	2531.082	UV	2533.80	4	Fe I Co II	27	2533.804 2533.823	7 18
2531.24	4	Ti II	4	2531.267	56	2533.91	2				
2531.42	3	Fe I		2531.429	7	2533.99	3	P I	8	2533.976	55
2531.54	3	Fe I	162	2531.51	UV	2534.10	2	Mg I Mn II	55	2534.072 2534.098	38 19
2531.60	1					2534.24	1	Mn II	55	2534.221	19
2531.76	1	Cr I	28	2531.76	UV	2534.35	4	Cr II	9	2534.33	UV
2531.83	4	Mn II Cr II	55 9	2531.799 2531.84	19 UV	2534.42	4D	Fe II	159	2534.413	UV
2531.98	2										

The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2534.56	1	Vd II	38	2534.519	UV	2537.44	4	Fe I	102	2537.458	7
2534.62	4	Ti II	4	2534.629	56	2537.53	1	Mg I		2537.557	38
2534.72	2					2537.75	1h				
2534.86	1					2537.84	2				
2534.96	1W	Mg I		2534.937	38	2537.94	2h	Mn II	55	2537.919	19
2535.08	1	Mg I		2535.079	38	2538.00	2h	Mn II	55	2538.041	19
2535.12	4	Fe I	60	2535.128	7	2538.21	4	Fe II	319	2538.205	UV
2535.30	3					2538.25	1	Fe I		2538.262	43
2535.47	5	Cr I II Fe II	9 177	2535.47 2535.480	UV UV	2538.39	3	Fe II Mg I	178	2538.393 2538.426	UV 38
2535.60	6	P I Fe I	8 7	2535.603 2535.607	55 7	2538.50	4	Fe II	160	2538.500	UV
2535.67	2	Mn II	21	2535.658	19	2538.60	3	Fe II	268	2538.577	UV
2535.74	1					2538.70	3	Fe II Fe I	363 57	2538.681 2538.699	UV 7
2535.86	4	Ti II	4	2535.885	56	2538.79		I Fe II	158	2538.794	UV
2535.96	4	Co I Mn II	3 21	2535.961 2535.977	UV 19	2538.82		Fe?		2538.829	7
2536.16	3					2538.91	5	I Fe II Cr I?	158 9	2538.898 2538.95	UV UV
2536.32	3w	Mg I		2536.303	38	2538.99	5	Fe II	158	2539.003	UV
2536.36	1H					2539.10	3	I Mg I Ni II	48	2539.089 2539.100	38 52
2536.43	1H	Mg I		2536.465	38	2539.20	2	Vd II?	186	2539.20	UV
2536.50	3	Hg I	1	2536.517	UV	2539.35	4	Fe I	55	2539.357	7
2536.69	5	Fe II	241	2536.673	UV	2539.51	1	Cr II	9	2539.52	UV
2536.82	5D	Fe I Fe II Fe II	58 159 159	2536.792 2536.822 2536.822	7 UV UV	2539.58	2	Fe I	56	2539.587	7
2537.17	5	I g "	363	2537.142	UV	2539.74	1	Mg I		2539.720	38
2537.36	2					2539.80	2	Fe II	176	2539.797	23
						2539.94	2				

## The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2540.02	3	Ni I Fe II	53 267	2540.019 2540.053	UV UV	2542.95	2w	Mn II Mn II	21 21	2542.923 2542.979	19 19
2540.23	2					2543.09	1	Fe II		2543.063	10
2540.27	3					2543.13	1	Cr II	108	2543.14	UV
2540.44	2	Fe		2540.441	7	2543.38	5	Fe II	159	2543.382	UV
2540.52	1	Mg I Fe II	349	2540.510 2540.531	38 23	2543.43	4	Fe II Mn II	177 21	2543.431 2543.454	UV 19
2540.66	5	Co II Fe II Fe II	27 177 343	2540.626 2540.669 2540.669	18 UV UV	2543.66	3	Mg I		2543.666	38
2540.71	3	Fe Mn II	32	2540.730 2540.749	7 19	2544.05	3	Mg I		2544.068	38
2540.97	6W	Fe I	7	2540.972	7	2544.24	4	Co I Cr II	3 9	2544.252 2544.26	UV UV
2541.09	4	Fe II Mn II	177 22	2541.096 2541.112	UV 19	2544.43	3w	Fe I Mg I	58	2544.462 2544.464	29 38
2541.26	3					2544.64	6	Fe I	58	2544.658	7
2541.39	2h	Cr I	29	2541.359	UV	2544.70	6	Cr I Fe I	9 162	2544.702 2544.705	UV 7
2541.62	3h					2544.80	1	Cu II	92	2544.805	25
2541.83	4	Fe II	158	2541.831	UV	2544.85	1	Co I		2544.862	50
2541.94	4	Ti I Co II	8 14	2541.910 2541.936	58 18	2544.96	3	Fe II	147	2544.972	UV
2542.09	5	Zr II Fe I	7 162	2542.09 2542.101	UV UV	2545.01	1	Co II	17	2545.038	18
2542.17	1					2545.21	4w	Cr I Fe II	27 159	2545.21 2545.215	UV UV
2542.32	2	Fe II Zn I	33 8	2542.316 2542.32	UV UV	2545.44	3	Fe II	267	2545.432	UV
2542.37	4W	Mg I Mg I		2542.350 2542.368	38 38	2545.54	4	Fe II	178	2545.513	UV
2542.68	1					2545.65	2	Cr I	24	2545.645	UV
2542.72	4	Fe II	223	2542.733	UV	2545.75	1	Mg I		2545.764	38
2542.84	2					2546.10	2	Fe		2546.104	7

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2546.16	3	Co II Fe I		2546.156 2546.174	18 7	2549.21	2				
2546.31	3w	Mg I		2546.304	38	2549.29	2	Vd II Co I	38 4	2549.272 2549.296	UV UV
2546.44	1	Cr II	108	2546.45	UV	2549.40	5	Fe II	177	2549.399	UV
2546.66	5	Fe II	177	2546.667	UV	2549.45	5	Fe II	177	2549.453	UV
2546.74	1	Co II		2546.745	18	2549.55	5	Ni I Ni II	51 48	2549.532 2549.548	UV 52
2546.86	5	Fe I Ti II		2546.866 2546.88	7 47			Cr I	24	2549.548	UV
2547.06	1					2549.61	6W	Fe I	7	2549.613	7
2547.22	2	Mg I		2547.21	38	2549.76	4	Fe II	266	2549.774	UV
2547.33	3	Fe II	158	2547.330	UV	2549.95	2	Vd I	15	2549.965	UV
2547.41	2	Ni I	52	2547.409	UV	2550.02	5	Fe II	240	2550.023	UV
2547.46	1	Fe I		2547.468	29	2550.13	4	Fe II	363	2550.155	UV
2547.65	2					2550.38	1	Cr I	25	2550.364	UV
2547.91	4	-Fe II?		2547.931	10	2550.52	3	Fe		2550.506	7
2548.08	4w	Cr II II Fe I	108 130	2548.04 2548.084	UV 7	2550.58	2	Fe II	158	2550.575	UV
2548.14	1	Fe II	176	2548.166	UV	2550.69	4	Fe II Zr II	240 7	2550.680 2550.71	UV UV
2548.32	4	Fe II Co I	146 112	2548.325 2548.333	UV	2550.81	3	Fe I	55	2550.812	29
2548.38	2	Mg I		2548.407	38	2551.10	5	Fe I Mg I		2551.092 2551.122	7 38
2548.51	3	Mg I		2548.51	38	2551.19	3w	Fe II	328	2551.16 2551.201	38 23
2548.58	2	Cr II Fe II	109 158	2548.58 2548.590	UV UV	2551.28	1	Fe II		2551.201	23
2548.65	2	Vd II	38	2548.685	UV	2551.38	1	Mn II?		2551.35	19
2548.74	5	Fe II Mn II	145 55	2548.741 2548.750	23 19	2551.45	2W				
2548.91	4	Fe II	319	2548.925	UV	2551.59	2	Cr II	109	2551.58	UV
2549.11	4w	Fe II-	284	2549.082	UV	2551.84	3	Mn II	32	2551.851	19

The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2551.98	3					2554.93	5	IP I- Fe II	8 205	2554.915 2554.950	55 UV
2552.19	2					2555.07	5	Fe II	177	2555.066	UV
2552.37	5	Sc II	1	2552.38	UV	2555.22	4	Co I	56	2555.074	UV
2552.55	2	Fe II		2552.544	10	2555.42	2	Fe		2555.219	7
2552.62	5	IIFe I	8	2552.606	7	2555.45	5	Cr I	26	2555.42	UV
2552.73	4	Vd I	15	2552.648	UV	2555.63	3	Fe II	177	2555.447	UV
2552.82	5W	Fe I	56	2552.786	43	2555.55	3	Cr I			
		Cr I	27	2552.79	UV			Fe I	58	2555.647	7
		IIFe I	55	2552.831	7	2555.98	4				
2552.97	4W	Vd II	69	2552.960	UV	2555.78	4				
		Co I	56	2553.004	UV	2556.20	3	Ti II	9	2555.988	UV
2553.04		Vd II	69	2553.028	UV	2556.31	5				
2553.18		Mn II		2553.158	19	2556.31	5	Ge I	25	2556.298	25
		Fe I		2553.193	UV	2556.55	4W	IIFe I	102	2556.303	7
2553.25	5	Mg I		2553.256	38			Fe I	56	2556.321	43
		P I	8	2553.262	55			Mg I		2556.55	38
		Mn II	55	2553.267	19	2557.00	3	Mn II	20	2556.573	19
2553.37	5	Co I	56	2553.337	UV	2557.06	3	Co I	55	2556.762	UV
		INi I	4	2553.373	UV	2557.16	2	IIFe I	53	2556.863	7
2553.49	3	Fe I	58	2553.49	43	2557.23	3	Mn II	20	2556.894	19
2553.67	2	Vd II	38	2553.668	UV	2557.27	4	Fe I		2557.020	29
2553.74	4	Fe II	127	2553.738	UV	2557.35	2	Fe II	158	2557.079	UV
		Mg I		2553.776	38	2557.45	2				
2553.86	2	Fe I?		2553.84	51	2557.45	2	Cr I	24	2557.144	UV
2554.05	2					2557.52	4d	Cr I	25	2557.144	UV
2554.22	4	Fe I		2554.218	29			Mg I		2557.226	44
2554.42	2	Fe II	298	2554.435	UV			Fe I	101	2557.270	7
2554.56	5W	Mg I		2554.565	38			Co II	17	2557.332	18
2554.71	1	Fe I	130	2554.711	43			Cr II	89	2557.45	UV
								Fe II	175	2557.500	UV
								Mn II	20	2557.543	19

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2557.60	1	Mn II	20	2557.594	19	2560.16	1	Ni II	62	2560.156	52
2557.77	3	Fe I		2557.792	29	2560.24	4	Sc II	1	2560.26	UV
2557.83	4	Mg I		2557.86	38	2560.28	5	Fe II	221	2560.278	UV
2557.97	3	Fe I		2557.982	29	2560.44	3	Fe II	158	2560.443	23
2558.11	3	Fe I		2558.118	29	2560.55	4	Mg I		2560.53	38
2558.20	1	Ca I	11	2558.174	45	2560.70	3	Cr I	24	2560.695	UV
	1	Ti I		2558.233	58	2560.78	2	Mn II?		2560.76	19
2558.27	1					2560.78		Fe I?		2560.777	43
	3H	Mn II-		2558.304	19	2560.87	1				
2558.37	2					2560.94	4w	Mg I		2560.941	44
2558.49	4w	Fe?		2558.478	7	2561.08	1	Fe I		2561.068	29
2558.60	3	Mn II	20	2558.605	19	2561.20	3				
2558.81	2	Fe I		2558.822	7	2561.27	4	Fe I	58	2561.271	7
2558.92	1	Vd I	15	2558.893	UV	2561.32	1	Cr I?	25	2561.33	UV
2559.10	5w	Fe I-		2559.080	29	2561.42	4	Ni I	3	2561.424	UV
2559.23	4	Fe II	266	2559.237	UV	2561.57	3w	Fe II	205	2561.584	UV
2559.33	4					2561.69	4	Fe		2561.700	7
2559.40	5	Co II	15	2559.407	18	2561.85	5	Fe I	55	2561.855	7
		Mn II		2559.413	19	2562.11	5w	Fe II-	221	2562.094	UV
2559.46	3							Co I	3	2562.124	UV
2559.56	1							Vd I	15	2562.125	UV
2559.66	3	Ni I		2559.655	UV	2562.23	5w	Fe I	55	2562.222	7
		Mn II	20	2559.679	19			Fe I	55	2562.225	7
								Mg I		2562.259	44
2559.77	4w	Mn II	20	2559.741	19	2562.54	7W	Fe II	64	2562.535	UV
		Fe II	205	2559.774	UV	2562.69	1				
2559.91	5w	Fe II	267	2559.921	UV	2562.89	1				
		Co II		2560.026	18	2563.08	2				

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2563.18	3					2565.85	3	Fe I		2565.870	43
2563.23	2	Sc II	1	2563.23	UV	2565.95	2	Ni II	62	2565.923	52
2563.41	5w	Fe I	54	2563.399	7	2565.98	1	Fe II	83	2565.959	10
2563.49	6W	Fe II	64	2563.472	UV	2566.00		Cr I	26	2566.00	UV
2563.65	5w	Mn II	20	2563.642	19	2566.02	2	Cr I	83	2566.00	UV
		Si I	44	2563.679	37	2566.21	4	Mn II	20	2566.035	19
2563.84	3	Fe I	55	2563.809	7	2566.40	3	Fe II	404	2566.218	23
		Fe II	266	2563.834	UV	2566.40		Fe II	405	2566.397	23
2563.88	2					2566.50	4	Mg I		2566.51	38
2563.99	2	Fe I		2563.990	29	2566.62	5	Fe II	174	2566.623	UV
2564.03	4	Co II	15	2564.036	18	2566.91	6W	Fe II	64	2566.908	UV
2564.17	3	Ti II		2564.179	56	2567.35	5w	Fe II?	419	2567.326	UV
2564.36	2w					2567.35		Co I	3	2567.344	UV
2564.56	4w	Fe I	58	2564.560	7	2567.63	3	Zr II	7	2567.62	UV
2564.82	4	Vd I	15	2564.817	UV	2567.80	5	Fe II		2567.637	7
		Si I	44	2564.824	37	2567.88	5	Zn I	8	2567.80	UV
2564.94	5	Mg I		2564.937	44	2567.97	7	Fe I	130	2567.859	7
2565.02	4					2568.10	2h	Al I	2	2567.983	14
2565.12	1	Ca I	11	2565.124	45	2568.17	3	Cr I	22	2568.098	UV
2565.21	3	Mg I	20	2565.19	38	2568.27	2				
		Mn II		2565.219	19	2568.33	3				
2565.26	3					2568.41	5	Fe II	145	2568.405	UV
2565.30	2	Fe II	419	2565.306	UV	2568.53	1	Mn II?	67	2568.515	19
2565.36	3	Co II	17	2565.371	18	2568.64	6w	Cr I	25	2568.52	UV
2565.46	3	Fe I?		2565.45	51	2568.86	6	Si I	85	2568.641	37
2565.52	1							Zr II	7	2568.85	UV
2565.58	2							Fe I	54	2568.865	7
2565.74	4							Fe II	175	2568.879	UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2568.96	2	Ti II		2568.977	56	2571.54	4	Fe II	174	2571.542	UV
2569.02	2					2571.68	3	Fe I	103	2571.57	UV
2569.08	2					2571.75	5	Hf II	11	2571.678	5
2569.19	3	Mg I		2569.20	38	2571.75		Cr I	24	2571.74	UV
2569.29	3					2571.87	1	Cr II	89	2571.78	UV
2569.34	5	Fe I— Fe II		2569.322	29	2572.05	3	Mn II?	67	2571.892	19
				2569.365	10			Fe I?— Cr I	22	2572.020	43
2569.46	2	Sr I	4	2569.469	UV	2572.15	3	Cr I	22	2572.15	UV
2569.58	5w	Fe I	52	2569.596	7	2572.24	5w	Co I II Mg I		2572.234	50
2569.76	6d	Fe I	55	2569.744	7	2572.36	1			2572.248	44
		Fe II	266	2569.775	23						
		Fe II	349	2569.775	23	2572.42	2				
2569.93	4					2572.54	3				
2570.24	1					2572.63	4	Ti II		2572.648	UV
2570.34	2					2572.75	5	Fe I	102	2572.753	7
{ 2570.48	5							Mn I	12	2572.755	UV
{ 2570.52	6	Fe II	412	2570.527	23	2572.85	2				
2570.68	1h					2572.95	4	Fe II	190	2572.965	23
{ 2570.84	5	Fe II	284	2570.843	UV	2573.12	1				
{ 2570.89	5	Mg I		2570.908	44	2573.20	4w	Fe II	205	2573.206	UV
{ 2570.93	4					2573.39	2	Co I		2573.395	50
2571.07	5	Ti II	9	2571.036	UV	2573.53	3	Co I		2573.538	50
2571.19	1	Fe II		2571.176	23			Cr II	232	2573.54	UV
		Ti II		2571.18	38	2573.62	2				
2571.27	2					2573.74	4d	Ti II— Fe II	9	2573.72	UV
2571.38	3								284	2573.754	UV
2571.45	3	Zr II	7	2571.42	UV	2573.92	2	Ti II— Fe II?		2573.91	47
		Zr II	7	2571.42	UV	2574.02	2	Vd I	15	2573.948	10
										2574.020	UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2574.18	3w					2577.66	4	ICr I Vd II	24 68	2577.66 2577.682	UV UV
2574.36	6W	Co I Fe II	3 144	2574.351 2574.363	UV UV	2577.91	7W	Mg I Fe II	64	2577.888 2577.920	44 UV
2574.52	2w	Vd II	38	2574.520	UV	2577.98	5W	Fe		2578.003	7
2574.59	2					2578.14	2				
2574.66	1	Cr I	67	2574.68	UV	2578.29	3d	Cr I Cr II	67 89	2578.27 2578.31	UV UV
2574.78	2w					2578.46	4	Ni I	28	2578.465	UV
2574.87	5	Co II	17	2574.867	18	2578.54	1				
2574.93	6	Mg I		2574.945	44	2578.65	3				
2575.08	7	Al I	2	2575.095	14	2578.81	5w	Fe I		2578.825	UV
2575.32	4					2578.91	1	Co I	113	2578.924	50
2575.39	6	Al I	2	2575.397	14	2578.98	2	Fe II	265	2578.985	UV
2575.50	5	Mn I	12	2575.509	UV	2579.12	4	Fe II Cr I	22	2579.127 2579.14	23 UV
2575.60	3					2579.18	5	Fe I		2579.183	43
2575.73	5	Co I Fe I	4	2575.733 2575.742	50 7	2579.26	6	Fe I Fe I	55 53	2579.260 2579.266	7 UV
2576.12	8W	Mn II	1	2576.105‡	19	2579.42	4d	Fe II Fe II	239 266	2579.406	UV
2576.43	3					2579.50	2	Fe I		2579.504	43
2576.53	4	Mg I		2576.545	38	2579.59	3				
2576.68	6	Fe I	52	2576.691	7	2579.67	1				
2576.86	5	Fe II	326	2576.859	UV	2579.84	4	Fe I		2579.844	7
2576.96	5	Fe I		2576.979	43	2580.05	5d	Cr I Cr I	26 26	2580.04 2580.04	UV UV
2577.16	5	Si I	84	2577.151	37	2580.32	5w	Fe II	54	2580.065	7
2577.22	2					2580.45	4	Fe I	54	2580.323	18
2577.32	4	Vd I—	15	2577.292	UV						
2577.43	4	Fe II	175	2577.431	UV						

The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2580.57	5	Mg I		2580.587	44	2583.85	1				
2580.67	2h					2584.00	3	Ni II	48	2583.998	52
2580.82	4	Co I		2580.838	50	2584.09	3	Cr II Mn I	89 12	2584.10 2584.100	UV UV
2580.96	2	Fe I	55	2580.939	29	2584.21	4	Mg I		2584.216	44
2581.12	3	Fe II	190	2581.111	23	2584.28	6	Mn I	12	2584.302	UV
2581.22	1	Co II		2581.217	18	2584.28		Mn I	12	2584.302	UV
2581.47	2	Fe		2581.464	7	2584.53	6w	Fe I	52	2584.536	7
2581.56	1					2584.64	3	Cr I	23	2584.67	UV
2581.73	4	Ti II— Fe I?		2581.707 2581.754	56 29	2585.26	4				
2581.83	1					2585.33	3	Co I	113	2585.335	UV
2582.13	3w	Cr II—	231	2582.10	UV	2585.55	5	Mg I		2585.558	44
2582.26	6D	Co II Fe I	14	2582.220 2582.297	18 UV	2585.61	4	Fe II	326	2585.629	UV
2582.40	4	Fe II	310	2582.422	UV	2586.46	3	Fe I Fe II	1	2585.875 2585.876	51 UV
2582.58	6W	Fe II	64	2582.582	UV	2586.56	3	Fe I	171	2586.557	UV
2582.80	4					2587.22	5	Co II	14	2587.221	18
2582.90	2	C I	60	2582.901	37	2587.26	3	Ni II	17	2587.289	52
2582.99	2	Vd II Cr I	68 67	2583.007 2583.02	UV UV	2587.34	2				
2583.05	5	Fe II	174	2583.047	UV	2587.60	2	Mn II	32	2587.598	19
2583.16	2	Co II		2583.178	18	2587.86	1				
2583.25	2	Ti I	7	2583.221	58	2587.98	6D	Fe II Fe I	326	2587.945 2588.010	UV UV
2583.36	3	Fe II	266	2583.343	UV	2588.19	4	Fe II	145	2588.182	23
2583.50	1							Cr I	22	2588.19	UV
2583.64	2d	Cr II	89	2583.61	UV	2588.27	5	Mg I		2588.285	44
2583.78	2	Fe I		2583.754	51	2588.47	2				

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2588.61	2					2592.78	5	Fe II	318	2592.781	23
2588.79	4	Fe II	265	2588.786	UV	2592.94	5	Mn I	12	2592.944	UV
2588.88	3	Fe I		2588.898	29	2593.08	3w				
2588.95	2	Mn II		2588.972	19	2593.24	5	IMg I Fe I	171	2593.231 2593.268	44 29
2589.05	2	Cr II	301	2589.05	UV	2593.52	5	Fe I	146	2593.510	UV
2589.18	2h	Ge I	2	2589.188	25	2593.72	7W	Fe II	64	2593.722	UV
2589.32	1	Fe II		2589.326	10	2593.72	IMn II	1		2593.724	19
2589.70	4w	Cr II Mn II	124 54	2589.70 2589.727	UV 19	2594.03	5	Fe I		2594.046	UV
2589.79	1					2594.14	5w	Fe I	52	2594.1	7
2589.97	2							Co I	3	2594.161	UV
2590.13	3	Mn II		2590.150	19	2594.27	2				
2590.25	3	Ti I	7	2590.247	58	2594.43	4				
2590.31	4					2594.47	3	Fe II		2594.483	38
2590.43	1					2594.70	3h	Fe II Mn II	36	2594.671 2594.733	10 19
2590.55	5	Fe II	145	2590.548	UV	2594.86	1				
2590.59	1	Co I	110	2590.594	UV	2594.96	3	Fe II	310	2594.964	UV
2590.71	4	Cr II	70	2590.72	UV	2595.20	1				
2590.86	3w	Fe I		2590.870	43	2595.28	4	Fe II	203	2595.278	38
2590.93	4							Fe II	172	2595.285	UV
2591.12	3					2595.41	3	Fe I	54	2595.425	7
2591.26	5	Fe I		2591.252	UV	2595.53	2	Cr II	262	2595.55	UV
2591.55	6W	Fe II	64	2591.542	UV	2595.62	1w				
2591.71	3	Co I	55	2591.686	UV	2595.78	5w	Mn I	12	2595.763	UV
2591.85	5	Cr I	24	2591.84	UV	2595.96	4	Mg I		2595.973	44
2592.27	4w	Fe I		2592.285	29	2596.07	3	Fe I	171	2596.077	29
2592.53	4	Ge I	1	2592.534	25	2596.15	2W	Cr II	217	2596.17	UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2596.43	5					2602.58	2				
2596.52	2					2602.72	3w	Mn II		2602.725	19
2596.60	4	Ti I— Fe I	6 51	2596.564 2596.618	58 29	2603.03	3	Mn II Fe I	54	2603.035 2603.042	19 29
2596.73	1w	Mn II	36	2596.745	19	2603.15	2				
2597.14	4					2603.41	3				
2597.44	4	Fe I		2597.443	29	2603.46	2				
2597.83	2					2603.56	5	Fe I Cr I	22	2603.554 2603.56	7 UV
2597.91	1	Fe II	342	2597.943	UV	2603.60	1				
2598.37	9W	Fe II	1	2598.369	UV	2603.73	3w	Mn II	36	2603.720	19
2599.14	4W					2603.86	6	Mg I		2603.854	44
2599.40	9W	Fe II	1	2599.395	UV	2604.01	5				
2599.57	5W	Fe I	52	2599.565	UV	2604.10	3	Ti II		2604.099	56
2600.20	2	Fe II— Fe I	203	2600.170 2600.202	38 UV	2604.17	1	Cr II	105	2604.16	UV
2600.31	1	Mn II	54	2600.283	19	2604.39	2	Co II		2604.401	18
2600.40	1W	Fe II	204	2600.415	UV	2604.51	1				
2600.60	1	Cr I	21	2600.61	UV	2604.66	4	Fe II	265	2604.655	UV
2600.78	1	Ni II?		2600.78	52	2604.74	5	Fe I		2604.754	7
2600.98	3	Co I	53	2600.977	UV	2604.86	4	Fe I Ti I	7	2604.864 2604.883	7 58
2601.05	1	Ni II	62	2601.029	52	2604.95	3				
2601.50	3	Mn II	54	2601.520	19	2605.03	3	Fe II	404	2605.034	23
2601.58	2					2605.13	4	Ti I	6	2605.121	58
2601.88	2	Cr II Cr I?	124 21	2601.85 2601.88	UV UV	2605.30	4	Fe II Ni II	342 62	2605.307 2605.331	UV 52
2602.35	2	Mn II?		2602.35	19	2605.42	5	Fe II	204	2605.416	UV
2602.49	5w	II Mg I Cr I	22	2602.495 2602.50	44 UV						

The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2605.67	6W	Fe I IMn II	51 1	2605.657 2605.682	7 19	2609.94	1	Ni II	62	2609.945	52
2605.90	4	Fe II	356	2605.895	23	2610.00	1	Fe		2610.006	7
2606.12	4w	Co I	55	2606.120	UV	2610.08	1				
2606.29	5d	-Fe		2606.303	7	2610.20	6	Mn II	19	2610.200	19
2606.51	5	lFe II Cr II Cr II	342 63 243	2606.514 2606.53 2606.53	UV UV UV	2610.30	1	Fe II?		2610.326	10
2606.61	5	Mg I		2606.621	44	2610.39	3w	Vd II?		2610.61	UV
2606.82	6	Fe I	52	2606.827	7	2610.75	5w	Fe I Co I	6 53	2610.750 2610.762	UV
2607.09	9W	Fe II	1	2607.086	UV	2610.93	2				
2607.74	3	Vd II?		2607.752	UV	2611.08	6d	Cr II? lFe II	124 64	2611.04 2611.075	UV
2607.81	4	Fe I	146	2607.823	43	2611.29	4	Ti I	6	2611.288	58
2607.91	3	Cr II	70	2607.90	UV	2611.35	4	Fe II	173	2611.339	UV
2608.12	3					2611.89	9W	Fe II	1	2611.873	UV
2608.20	4	Cr II-	105	2608.17	UV	2612.38	2	Ni I	4	2612.400	38
2608.30	1	Fe I		2608.292	43	2612.64	3	Fe II		2612.641	38
2608.43	2d	Fe II Ti II		2608.400 2608.45	23 38	2612.77	6	Fe I	6	2612.772	7
2608.58	5	Fe I		2608.577	7	2613.27	3	Fe I Cr I	21	2613.265 2613.305	UV
2608.77	1w					2613.36	2	Mg I	14	2613.357	44
2608.84	5	Fe II	171	2608.852	UV	2613.50	3	Co II- Cr II	17 269	2613.494 2613.51	UV
2609.05	3	Fe?		2609.036	7	2613.58	3	Fe II	172	2613.576	UV
2609.12	4	Fe II	310	2609.122	UV	2613.85	8W	Fe II	1	2613.820	UV
2609.20	4	Fe I		2609.221	7	2614.12	3	Co I	3	2614.124	UV
2609.43	4	Fe II	265	2609.431	UV	2614.18	4	Fe II	264	2614.177	UV
2609.58	5	Fe		2609.579	7	2614.18					
2609.86	4w	Fe II	204	2609.859	UV						

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2614.33	4					2618.36	4	Cu I	18	2618.366	UV
2614.36	5	Co II	20	2614.359	18	2618.53	3				
2614.49	6	Fe I	52	2614.494	7	2618.57	3				
2614.58	3	Fe II	203	2614.561	10	2618.71	7	Fe I	6	2618.710	7
2614.72	5	Mg I	14	2614.726	44	2618.85	5	Fe I		2618.850	29
2614.87	5	Fe II	171	2614.867	UV	2618.91	3	Mn I	27	2618.911	UV
2614.94	3w					2619.03	5				
2615.04	1	Ni II	65	2615.056	52	2619.07	5	Fe II	171	2619.071	UV
2615.21	4					2619.15	3				
2615.42	5	Lu II Fe I		2615.42‡ 2615.422	35 7	2619.27	3	Co I	55	2619.276	50
2615.51	2					2619.35	1				
2615.80	3					2619.50	4w	Cr I Mn I	58 26	2619.504 2619.510	UV 4
2615.85	4	Fe I		2615.849	7	2619.68	3				
2615.99	5					2619.80	2	Ti I	5	2619.800	58
2616.15	2h	Cr II?		2616.18	UV	2619.95	4w	Ti I— Mn I	6 27	2619.940 2619.980	58 4
2616.26	3	Vd II Co I	90 112	2616.24 2616.260	UV UV	2620.16	6	Fe II	173	2620.175	UV
2616.40	4d					2620.41	7w	Fe II	1	2620.408	UV
2616.50	3	Mn II	19	2616.521	19	2620.69	6	Fe II	171	2620.693	UV
2616.86	3					2620.80	3	Ni I	3	2620.825	38
2617.13	5	Fe		2617.132	7	2620.89	1w	Fe II	203	2620.899	38
2617.36	4w					2621.06	1	Fe II?		2621.076	10
2617.63	8w	Fe II	1	2617.618	UV	2621.19	2				
2618.02	7	Fe I	52	2618.018	7	2621.41	2				
2618.13	6	Mn II	19	2618.145	19	2621.46	3	Fe I		2621.472	43
2618.26	3w	Cr I	20	2618.273	UV	2621.68	8w	Fe II	1	2621.669	UV

## The Echelle Solar Spectrum (Continued)

Solar			Laboratory				Solar			Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref		
2621.95	5	Fe I?		2621.965	7	2625.92	4	Fe II	203	2625.889	38		
2622.05	4	Co I	54	2622.059	UV	2626.00	2						
2622.25	3	Co I	54	2622.250	UV	2626.16	2						
2622.29	2					2626.42	3	Ni II	62	2626.426	52		
2622.42	3	Co I	54	2622.430	UV	2626.50	6	Fe II	173	2626.499	UV		
2622.65	1					2626.60	3	Cr I	21	2626.601	UV		
2622.74	1	Hf II	8	2622.739	5	2626.64	3	Mn I	26	2626.635	4		
2622.87	5	Cr I	21	2622.867	UV	2626.68	4	Fe II	203	2626.695	UV		
2622.90	3	Mn I	27	2622.895	UV	2626.86	3						
2623.00	3					2627.03	3w						
2623.13	3	Fe II	318	2623.129	UV	2627.14	5	Fe I		2627.127	7		
2623.29	1	Mn I?	24	2623.284	4	2627.22	4	Fe I	51	2627.224	7		
2623.37	6	II Fe I Cr II	6 124	2623.366 2623.39	UV	2627.46	2						
2623.54	7	Fe I	52	2623.533	7	2627.63	3h	Co I	54	2627.638	UV		
2623.63	4	Fe		2623.626	7	2628.30	8W	Fe II	1	2628.291	UV		
2623.73	5	Fe II Co I	171	2623.721 2623.755	UV 50	2628.55	2w	Fe II	203	2628.569	UV		
2624.04	3	Mn I	27	2624.043	UV	2628.99	2w	Fe I		2629.000	43		
2624.13	4					2629.18	3	Fe I?		2629.19	51		
2624.43	1	Fe II?		2624.455	10	2629.38	1w						
2624.50	1					2629.58	7	Fe I Fe II	6 171	2629.572 2629.590	7 UV		
2624.66	3	Fe		2624.661	7	2629.72	3	Fe		2629.721	7		
2624.77	4w	Mn II	19	2624.761	19	2629.82	4	Cr I	20	2629.815	UV		
2625.32	4	Cr I	20	2625.318	UV	2630.07	7W	Mg I	13	2630.053	44		
2625.50	6	Fe II	318	2625.489	23			Fe II	171	2630.068	UV		
2625.68	8W	Fe II	1	2625.664	UV	2630.29	2						

The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2630.59	2	Mn I	24	2630.565	4	2635.00	1	Fe II		2634.993	23
2630.69	5	Vd II	150	2630.665	UV	2635.31	5	Fe II?—		2635.314	10
2630.81	3					2635.40	4	Fe II	238	2635.401	UV
2631.04	8W	Fe II	1	2631.045	UV	2635.56	1	Fe II	296	2635.401	UV
		Fe II	171	2631.045	UV						
2631.33	8W	Fe II	1	2631.321	UV	2635.65	3				
2631.61	7	Fe II	171	2631.607	UV	2635.71	4	Fe		2635.723	7
2632.02	2	Mn II	19	2632.006	19	2635.81	7	Fe I	52	2635.809	7
2632.11	2					2635.93	3	Fe		2635.932	7
2632.24	6	Fe I	52	2632.237	7	2636.10	3w	Co II		2636.072	18
		Co II	20	2632.260	18			Fe		2636.075	7
2632.36	5	Mn II	19	2632.354	19	2636.49	6	Cr I?	19	2636.094	UV
2632.42	4	Ti I	5	2632.414	58			Cr II	62	2636.46	UV
2632.60	6	Fe I	6	2632.594	7	2636.70	4	Fe II	51	2636.478	7
2632.87	5w	Mg I	13	2632.873	44	2636.79	5				
{2632.99	5	Fe?		2632.988	7	2636.96	4				
2633.05	4	Fe II	203	2633.070	38	2637.05	5	Fe?		2637.054	7
2633.20	4	Fe II	356	2633.200	23	2637.20	3d	Cr I?—	19	2637.168	UV
2633.32	1					2637.34	1	Cr II	62	2637.20	UV
2633.42	4	Fe II?		2633.410	38	2637.48	3	Fe II		2637.48	UV
2633.54	3	Ni II?	45	2633.558	52			Fe II	198	2637.515	UV
2633.62	4	Fe I?		2633.621	7	{2637.64	5	Fe II	410	2637.643	UV
2634.03	3h					{2637.68	1	Al II	221	2637.689	26
2634.35	4					2637.89	3		14		
2634.74	5	Fe?		2634.740	7	2638.15	6	Mn II	19	2638.173	19
2634.93	2h	Fe I?		2634.917	43	2638.36	1				
		Co II		2634.923	18	2638.46	1				

The Echelle Solar Spectrum (Continued)

Solar			Laboratory				Solar			Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref		
2638.58	2	Fe Mn II		2638.560 2638.567	7 19	2641.64	6	Fe I	50	2641.646	7		
2638.73	3d	Ti II? Fe	29	2638.70 2638.747	UV 7	2641.74	3w						
2638.91	2	Cr I		2638.892	28	2642.01	4	Fe II	309	2642.015	UV		
2639.04	3					2642.12	3	Cr I	66	2642.118	UV		
2639.08	3	Zr II	4	2639.07	UV	2642.21	3	Vd II	89	2642.212	UV		
2639.16	4					2642.27	4	Fe I	51	2642.274	29		
2639.37	3	Ni II?		2639.358	52	2642.38	1	Fe II		2642.382	23		
2639.42	3					2642.61	1w						
2639.57	5	Fe II	221	2639.560	UV	2642.77	1						
2639.86	5	Mn II	52	2639.849	19	2642.87	1w	Co I		2642.884	50		
2639.93	2					2642.96	2	Fe II	426	2642.982	23		
2640.04	2	Cr I	20	2640.056	UV	2643.17	2d	Ni I-	72	2643.146	UV		
2640.20	4	Fe I?		2640.23	51	2643.28	1						
2640.31	3					2643.39	2	Zr II		2643.40	UV		
2640.48	2w					2643.52	3	Cr II	123	2643.54	UV		
2640.62	1					2643.75	2h	Fe II		2643.763	23		
2640.71	1					2643.99	7	Fe I	52	2643.998	7		
2640.79	1h					2644.26	5	Ti I	5	2644.253	58		
2641.03	4	Fe I		2641.029	7	2644.34	3						
2641.11	2	lTi I Fe II	5 144	2641.089 2641.124	58 UV	2644.52	1						
2641.17	2					2644.60	2	Fe		2644.628	7		
2641.30	1w					2644.80	4w	Mg I	12	2644.801	44		
2641.42	3	Hf II	7	2641.410‡	5	2645.03	2						
2641.50	4	Au I-	4	2641.49	UV	2645.08	4	Fe II	263	2645.084	UV		
								Fe II	309	2645.084	UV		

The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2645.19	2	Fe II	421	2645.191	23	2648.54	4	Fe I		2648.548	29
2645.33	2	Fe II	426	2645.328	23	2648.64	4	Co I	53	2648.635	UV
2645.42	5	Fe I	6	2645.422	7			Co I	53	2648.635	UV
2645.64	2	Fe II		2645.637	10	2648.72	6	Fe II	409	2648.704	UV
2645.84	4	Vd II	89	2645.840	UV	2648.75	2				
2645.97	2					2648.94	3	Mn II	53	2648.938	19
2646.05	2	Fe Ti II	29	2646.032 2646.088	7 56	2649.06	6	Mg I	12	2649.062	44
2646.14	2					2649.23	4				
2646.21	5w	Fe II Mg I	237 12	2646.206 2646.206	UV 44	2649.29	3	Ti I		2649.291	58
2646.32	3	Fe I?		2646.320	43	2649.63	4				
2646.41	4	Co I	53	2646.413	UV	2649.75	2				
2646.51	2	Fe I?		2646.50	51	2649.82	3				
2646.65	5w	Ti I	5	2646.631	58	2649.93	3w	Co I	112	2649.931	UV
2646.85	1	Pt I	1	2646.87	UV	2650.21	3				
2646.91	1					2650.26	4	Co I	53	2650.266	UV
2647.25	4					2650.38	1	Zr II	6	2650.37	UV
2647.39	3	Fe I		2647.390	29	2650.47	4	Be I— Fe II	2 410	2650.454 2650.492	UV
2647.56	6	Fe I	6	2647.558	7	2650.62	3w	Be I	2	2650.613	22
2647.71	1	Vd I	13	2647.710	UV			Be I	2	2650.619	22
2647.85	1w					2650.68	4	Be I	2	2650.694	22
2648.08	3	Cr II	142	2648.08	UV	2650.78	2	Be I	2	2650.760	22
2648.17	5	Fe I	99	2648.164	29	2650.86	1	Pt I	6	2650.84	UV
2648.27	3w					2651.04	3	Mn II	52	2651.036	19
2648.45	4					2651.10	2				
						2651.18	5	Ge I	1	2651.172‡	25

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2651.28	3w	Fe II	237	2651.297	UV	2655.14	3	Fe I	100	2655.14	UV
2651.56	3	Ge I	1	2651.568	25	2655.35	1				
2651.70	5	Fe II	355	2651.691	UV	2655.52	3				
		Fe I	51	2651.706	7	2655.65	3W				
2651.83	3	Fe II	427	2651.826	23	2655.78	3	Cr II	103	2655.78	UV
2651.88	2	Vd I	13	2651.896	UV	2655.91	4	Mn II	52	2655.924	19
2652.00	3	Cr II?		2652.00	UV	2656.09	3				
2652.10	4					2656.14	5	Fe I	156	2656.147	7
2652.16	4					2656.32	4	Fe I		2656.337	29
2652.49	6	Al I	1	2652.475	14	2656.39	4	Ti I?		2656.359	58
2652.56	5	Fe II	237	2652.557	UV	2656.80	5	Fe I	99	2656.792	UV
2652.85	2					2656.93	2	Ti I?		2656.903	58
2652.93	2	Ti I	4	2652.975	58	2657.19	2	Ti I	3	2657.178	58
2653.05	3					2657.44	4				
2653.14	2	Fe I	156	2653.134	43	2657.51	3h	Fe I		2657.489	43
2653.26	4					2657.91	4	Fe II	283	2657.917	UV
2653.35	1					2658.10	4d	-Fe I		2658.111	29
2653.58	5	Cr II	8	2653.57	UV	2658.26	4	Fe II	309	2658.251	UV
2653.72	4	Co II	20	2653.719	18	2658.49	5	Fe		2658.478	?
2654.06	2w					2658.59	6	Cr II	8	2658.59	UV
2654.27	4	Fe I?		2654.28	51	2658.68	4	Fe I		2658.699	29
2654.43	3	Cr I		2654.412	28	2658.93	5w	Cr II-	141	2658.91	UV
2654.62	2	Fe II	410	2654.639	UV	2659.06	2	Fe II	237	2659.054	UV
2654.71	2					2659.25	3	Fe I		2659.249	7
2654.79	1					2659.35	1				
2654.93	1	Ti I	4	2654.921	58	2659.39	1				

The Echelle Solar Spectrum (Continued)

Solar			Laboratory				Solar			Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref		
2659.45	2w	lPt I Cr II Cr II	1 103 164	2659.44 ‡ 2659.47 2659.47	UV UV UV	2662.70	3	-Cr II?	165	2662.72	UV		
2659.60	1w					2662.93	1h	Fe?		2662.901	7		
2659.69	3h					2663.01	3	Cr II	165	2663.02	UV		
2659.83	3					2663.17	4	Fe I		2663.165	7		
2659.99	1h	Cr I	58	2660.006	UV	2663.42	6	Cr II	8	2663.42	UV		
2660.11	3					2663.64	4						
2660.39	7w	Al I Fe I	1 51	2660.386 2660.397	14 7	2663.68	5	Cr II	8	2663.67	UV		
2660.47	3					2663.78	5	Fe?		2663.779	7		
2660.58	3					2663.92	4	Fe II	428	2663.945	7		
2660.76	3w	Mg II Mg II	4 4	2660.755 2660.817	44 44	2664.05	5w	Fe I		2664.043	7		
2660.90	3h					2664.18	6d	Fe I Fe II	237	2664.168 2664.209	UV		
2661.20	5	Fe I	50	2661.191	7	2664.47	1h	Cr I	8	2664.44	UV		
2661.30	5d	Mg II Fe I		2661.292 2661.305	38 7	2664.66	7w	Fe II	263	2664.665	UV		
2661.42	4	Cr II? Fe?— Vd I	13	2661.41 2661.416 2661.424	UV 7 UV	2665.05	3	Ga I	3	2665.05	UV		
2661.52	2					2665.18	1	Mn II	62	2665.179	19		
2661.61	2	Cr II	62	2661.59	UV	2665.28	4	Ni II	45	2665.252	52		
2661.67	5					2665.35	3						
2661.74	6d	lCr II Fe II	8 429	2661.73 2661.771	UV 7	2665.56	3	Fe II	428	2665.563	UV		
2661.96	3	Ti I	2	2661.962	58	2665.83	4	Ni II	45	2665.852	52		
2662.06	5	Fe I	50	2662.056	7	2666.01	7W	Cr II	8	2666.02	UV		
2662.31	5	Fe I		2662.304	7	2666.39	5	Fe I	50	2666.399	7		
2662.58	5	Fe II—	410	2662.563	UV	2666.44	5	Fe II	263	2666.631	UV		

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2666.77	4	Fe Mn II		2666.751 2666.769	7 19	2669.94	2w	Fe II	416	2669.932	23
2666.81	5w	Fe I	48	2666.812	7	2670.08	4w	Cr II	63	2670.06	UV
2666.96	5	Fe I	100	2666.965	7	2670.22	3	Cr II	69	2670.24	UV
2667.03	5	Mn II Mn II	52 70	2667.030 2667.030	19 19	2670.32	2	Ni II	45	2670.326	52
2667.22	3	Fe II	410	2667.221	UV	2670.52	1w	Zn I	6	2670.530	UV
2667.37	2D					2670.70	1				
2667.56	1h					2670.78	4	Fe I		2670.786	7
2667.78	2	Zr II	5	2667.77	UV	2670.96	1	Zr II	20	2670.94	UV
2667.91	5	Fe I	6	2667.912	7	2671.00	2	Fe		2670.992	7
2668.14	5	Mg I	11	2668.124	44	2671.37	2	Fe II	410	2671.404	UV
2668.25	1	Fe II?		2668.235	10	2671.57	2				
2668.34	1	Ti I	4	2668.319	58	2671.81	6	Cr II	8	2671.80	UV
2668.52	1					2672.00	5	Cr I Vd II	18 3	2671.980 2672.005	UV UV
2668.59	1					2672.10	3				
2668.72	5w	Cr II	8	2668.71	UV	2672.23	3	Fe I?		2672.20	51
2668.91	4	Fe I— Fe II	429	2668.910 2668.938	7 UV	2672.31	3	Fe II	202	2672.310	UV
2669.01	3	Fe II	429	2669.023	UV	2672.37	3	Cr II	122	2672.37	UV
2669.16	5	Al II	1	2669.157	26	2672.47	6	Mg I	11	2672.460	44
2669.36	3	Cr I	18	2669.359	UV	2672.58	4	Mn II	34	2672.581	19
2669.41	4					2672.83	6w	Cr II	8	2672.83	UV
2669.49	5	Fe I	156	2669.493	7	2673.10	4	Fe?		2673.086	7
2669.55	5	Mg I	11	2669.553	44	2673.21	5	Fe I	50	2673.213	7
2669.60	5	Ti I	2	2669.592	58	2673.38	3	Mn II	52	2673.379	19
2669.78	3h					2673.49	2				

## The Echelle Solar Spectrum (Continued)

Solar			Laboratory				Solar			Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref		
2673.55	3	Fe I		2673.552	29	2677.71	2						
2673.70	3d					2677.80	5	Vd II	3	2677.804	UV		
2673.76	1					2677.85	2	Mn II	52	2677.851	19		
2673.96	1	Vd II	14	2673.955	UV	2678.02	5	Ni I	69	2678.026	UV		
2674.09	1	Ti I	2	2674.089	58	2678.15	4	Cr I	18	2678.15	UV		
2674.18	4	Fe I?—		2674.18	51	2678.21	3						
2674.44	2	Mn II	63	2674.440	19	2678.26	4	Fe II?		2678.247	10		
2674.62	3	Fe I		2674.625	29	2678.35	1	Ti I		2678.341	58		
2674.72	3	Fe I	140	2674.715	7	2678.40	1						
2674.99	4	Mn II	52	2674.985	19	2678.57	5	Vd II Zr II	3 4	2678.572 2678.59	UV UV		
2675.15	1	Fe II?		2675.133	10	2678.65	4						
2675.28	5	Fe I Pt I	7	2675.276 2675.301	51 55	2678.79	7	Cr II	7	2678.79	UV		
2675.51	2	Fe II?		2675.477	23	2679.06	7w	Fe I	47	2679.062	7		
2675.67	3	Cr II	69	2675.67	UV	2679.16	2	Mn II	52	2679.166	19		
2675.78	2					2679.21	4						
2675.98	4	Au I Co I	1 53	2675.95 2675.980	UV UV	2679.32	5	Vd II	3	2679.327	UV		
2676.08	5	Ti I Fe I?	4	2676.072 2676.078	58 7	2679.49	3	Fe I		2679.513	29		
2676.16	3	Fe I		2676.159	7	2679.74	4w	Fe I Fe II		2679.714 2679.775	7		
2676.30	1w	Mn I?	15	2676.326	4	2679.92	3	Cr II Ti I	267 2	2679.89 2679.923	UV 58		
2676.53	3h												
2676.65	1	Fe I?		2676.62	51	2680.13	5	Fe		2680.117	7		
2676.90	4	Fe II	426	2676.881	23	2680.28	4	Fe II?	408	2680.244	UV		
2677.16	7D	Cr II Pt I II Cr II	8 1 8	2677.13 2677.13 2677.19	UV UV UV	2680.33	4	Cr I Mn II	18 63	2680.33 2680.338	UV 19		
						2680.46	5	Fe I	50	2680.453	7		

The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2680.67	3d	Mn II Fe II	429	2680.681 2680.702	19 7	2684.56	5w	Mn II- Fe II	63 283	2684.539 2684.752	19 UV
2680.79	3	Fe II	202	2680.784	UV	2684.75	6	Fe I	50	2684.857	UV
2680.91	3	Fe I	100	2680.913	7	2684.85	5	Fe II	201	2684.940	UV
2681.05	1	Fe II Fe II	416 429	2681.038 2681.038	23 23	2684.95 2685.03	5	-Cr II	122	2685.04	UV
2681.25	2	Mn II		2681.252	19	2685.15	5w	Ti I Fe I	2	2685.137 2685.140	58 7
2681.34	2					2685.22	1	Cr II Cr II	85 85	2685.19 2685.19	UV UV
2681.46	4	Cr I	8	2681.46	UV	2685.33	4	Co I	53	2685.336	UV
2681.58	5	Fe I	145	2681.586	UV	2685.49	2w				
2681.71	1w	Mn I		2681.723	UV	2685.68	4	Vd II	3	2685.689	UV
2681.88	2	Fe?		2681.885	7	2685.87	3w	Mn II	44	2685.883	19
2682.03	1	Cr I	18	2682.01	UV	2685.99	3	Mn II Mn II- Cr II?	62 68	2685.983 2685.983 2686.00	19 UV
2682.20	5	Fe I		2682.211	7	2686.11	4w	Fe II	202	2686.100	UV
2682.36	1	Mn II	63	2682.368	19	2686.19	1w	P I	7	2686.183	55
2682.54	3d	Fe II	425	2682.510	23	2686.39	4	Fe II	262	2686.388	UV
2682.87	5w	Vd II	3	2682.875	UV	2686.51	1	Fe II		2686.482	23
2682.91	2					2686.61	3w	Fe?		2686.604	7
2683.00	2	Fe II	416	2682.989	23	2686.74	5	Fe I		2686.745	51
2683.07	4	Vd II	3	2683.09	UV	2687.09	6w	Cr II- Fe I	7	2687.09 2687.415	UV 7
2683.20	2					2687.42	5	Cr II?	84	2687.60	UV
2683.44	2W	Cr II	268	2683.45	UV	2687.62	1	Zr I?	11	2687.74	UV
2683.72	1W	Fe I		2683.710	7	2687.74	3				
2683.82	2	Mn II	62	2683.833	19	2687.79	5	Fe I		2687.801	7
2683.94	6	Fe I		2683.936	7	2687.94	6	Vd II	3	2687.960	UV
2684.08	6	Fe I		2684.068	7						
2684.18	3	Zn I	6	2684.161	UV						
2684.26	1	Ni II	63	2684.277	52						

## The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2688.02	4w	P I I Cr I	7 18	2688.000 2688.035	55 UV	2691.03	6W	I Cr II Cr II	8 85	2691.03 2691.03	UV UV
2688.14	2					2691.16	1				
2688.24	4					2691.34	4	Ge I	1	2691.341	25
2688.28	5	Cr II	84	2688.28	UV	2691.48	4	Fe I		2691.490	7
2688.40	3	Cr II	186	2688.41	UV	2691.64	1				
2688.50	2					2691.75	4d	Mn II II Fe II	202	2691.717 2691.732	19 UV
2688.70	5	Vd II	3	2688.717	UV	2691.98	3h	Mn II		2691.981	19
2688.82	2	Ti I		2688.826	58	2692.11	3	Cr II	84	2692.11	UV
2689.04	3	Cr II	84	2689.03	UV	2692.24	4	Fe I	98	2692.248	7
2689.20	7W	Cr II Fe I	85 48	2689.20 2689.212	UV 7	2692.45	2w	Cr I I Mg I	18	2692.441 2692.45	UV 44
2689.41	6	Fe I		2689.415	7	2692.61	6D	Fe II Fe I	283 50	2692.601 2692.650	UV 7
2689.48	5	Mg I		2689.50	44	2692.82	6w	Fe II	62	2692.826	UV
2689.68	3	Ti I Ni I	2 71	2689.675 2689.680	58 UV	2692.97	1	Fe		2693.005	7
2689.78	7W	Mn II Cr II	44 188	2689.787 2689.79	19 UV	2693.08	3w				
2689.83		Fe I	99	2689.829	7	2693.18	4	Mn II	34	2693.192	19
2689.88		Vd II	3	2689.883	UV	2693.34	1w	Cr I? Fe	57	2693.315 2693.355	UV 7
2690.07	6	Fe I	4	2690.069	7	2693.54	5	Zr II Cr II	4 84	2693.52 2693.53	UV UV
2690.25	5	Cr I IVd II	18 3	2690.251 2690.252	UV UV	2693.71	4	Mg I	10	2693.723	44
2690.37	3	Fe I		2690.422	43	2693.85	4	Fe II	261	2693.852	UV
2690.42	3	Fe?				2693.94	2				
2690.50	3W	Ti I		2690.612	58	2694.07	2d	Zr II Fe II	40	2694.05 2694.075	UV 10
2690.62	3	Vd II	3	2690.792	UV	2694.23	4	Fe I	4	2694.239	7

## The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2694.38	2w	Co I		2694.392	50	2698.14	5D	II Mg I Fe I	10	2698.145 2698.165	44 7
2694.53	6	Fe I	144	2694.536	UV	2698.23	2				
2694.67	5	Co II	13	2694.684	18	2698.39	5w	Cr II	7	2698.40	UV
2694.88	2	Cr I	80	2694.887	UV	2698.68	5W	Cr II	7	2698.68	UV
2695.02	6	Fe I	47	2695.034	7	2698.76	4				
2695.18	7	Mg I	10	2695.181	44	2698.83	3	Cr II	289	2698.85	UV
2695.32	6d	-Mn II	34	2695.365	19	2698.98	4	Mn II	35	2698.989	19
2695.53	7	Fe I		2695.530	7	2699.09	6	Fe I	48	2699.106	7
2695.63	7	Fe I	145	2695.651	7	2699.17	1	Fe II	416	2699.185	23
2695.85	4	Co I	53	2695.846	UV	2699.32	3	Cr II	141	2699.34	UV
2695.98	6	Fe I		2695.989	7	2699.45	1h	Fe		2699.452	7
2696.27	6	Fe I	143	2696.283	7	2699.58	4	Zr II	5	2699.59	UV
2696.37	4					2699.76	4	Fe I	4	2699.775	7
2696.48	5	Ni I	49	2696.484	UV	2700.12	2	Zr II	5	2700.12	UV
2696.53	3	Cr I	8	2696.534	UV	2700.28	2h				
2696.75	3	Cr II	84	2696.76	UV	2700.58	4	Cr I	17	2700.590	UV
2696.88	3	Fe?		2696.895	7	2700.72	1				
2697.02	5	Fe I	100	2697.021	7	2700.92	5	Vd II	1	2700.944	UV
2697.19	4	Cr I	17	2697.200	UV	2701.06	4D	Mn II-Cr II	34 62	2701.024 2701.10	19 UV
2697.34	5	Fe II	341	2697.330	UV						
2697.48	5D	Fe II Cr II	341 186	2697.453 2697.51	UV UV	2701.17	4	Mn II	35	2701.170	19
2697.64	2					2701.45	3				
2697.72	3	Fe II	325	2697.726	UV	2701.52	4	-Vd II	2	2701.535	UV
2697.90	5	Cr II	84	2697.90	UV	2701.64	4	Cr II	62	2701.65	UV
		Cr II	267	2697.90	UV	2701.68	5	Mn II	18	2701.698	19
2698.03	4					2701.87	3				

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2701.91	4	Fe I	161	2701.909	7	2704.72	1				
2701.99	4	Cr I	18	2701.990	UV	2704.76	2	Cr I	65	2704.744	UV
2702.18	4	Vd II	2	2702.185	UV	2705.06	2	Fe I		2704.748	7
2702.28	4	Fe I	155	2702.263	43	2705.20	3	Vd II	2	2705.220	UV
2702.44	4	Fe I	154	2702.449	7	2705.26	2				
2702.55	4	Cr I	64	2702.519	UV	2705.44	3d	Cr I -	64	2705.414	UV
2702.69	1							Ni I	48	2705.463	UV
2702.75	2					2705.54	2	Mn II	34	2705.561	19
2702.90	1	Ni II	45	2702.905	52	2705.72	5	Cr I	17	2705.724	UV
2702.99	1	Fe I?		2702.97	51			Cr I	18	2705.724	UV
2703.13	1	Mn I?		2703.129	4	2705.84	1	Mn II	18	2705.732	19
2703.24	2	Mn II?	34	2703.22	19	2705.90	1	Pt I	6	2705.88	UV
2703.31	1					2706.01	7W	Fe I	154	2706.012	UV
2703.47	4D	Mn II	18	2703.453	19	2706.14	5	Vd II	1	2706.17	UV
		Cr I	18	2703.48	UV						
2703.55	5	Cr II	84	2703.56	UV	2706.52	5	Ni I	70	2706.521	UV
2703.62	1	Ni I		2703.615	UV	2706.58	6	Cr I	64	2706.531	UV
2703.69	1w	Mn I		2703.658	4	2706.68	5	Fe II	341	2706.566	UV
2703.85	6	Cr II	7	2703.85	UV	2706.83	2	Fe I	48	2706.582	7
2703.98	6	Mn II	18	2703.98	19	2706.87	4	Fe		2706.821	7
		Fe II	261	2703.988	UV						
2704.08	2					2707.03	4	Fe		2706.879	7
2704.24	1					2707.08	3	Ti II		2707.057	56
2704.31	1					2707.13	4	Fe II	339	2707.128	UV
2704.56	3	Fe II	202	2704.569	UV	2707.34	1	Co II?	29	2707.349	18
						2707.45	4	Fe I		2707.448	7
						2707.54	4	Mn II	18	2707.544	19

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2707.68	2h	Cr I?	56	2707.69	UV	2710.54	5	Fe I	100	2710.544	7
2707.86	4	Vd II	2	2707.86	UV	2710.62	1	Mn II		2710.629	19
2708.04	3	Fe I		2708.040	7	2710.68	1				
2708.13	3					2710.83	1	Fe I?		2710.85	51
2708.30	1W					2710.93	2	Cr II	289	2710.92	UV
2708.44	4	Mn II	18	2708.452	19	2711.05	3	Fe		2711.051	7
2708.57	5	Fe I	161	2708.571	7	2711.19	3w	Cr II	187	2711.19	UV
2708.64	5	Fe		2708.653	7	2711.27	1	Fe I	98	2711.265	43
2708.70	2	Fe II		2708.713	10	2711.40	1				
2708.79	4	Cr II—Mn II	186 18	2708.78 2708.814	UV 19	2711.47	5	Zr II	4	2711.48	UV
2708.88	3	Fe		2708.890	7	2711.56	2	Mn II	18	2711.568	19
2709.05	5	Fe II	218	2709.051	UV	2711.65	6	Mn II Fe I	18 47	2711.630 2711.655	19 7
2709.20	1					2711.74	5	Vd II	2	2711.740	UV
2709.31	3	Cr II	186	2709.31	UV	2711.84	5	Fe II	201	2711.842	UV
2709.37	4	Fe II	62	2709.373	UV	2712.31	5	Cr II	7	2712.30	UV
2709.62	4	Ge I	1	2709.624	25	2712.39	4	Fe II	201	2712.386	UV
2709.71	1	Fe I	180	2709.691	7	2712.49?	1	Zn I	6	2712.488	UV
2709.82	2					2712.68	1	Fe?		2712.685	7
2709.93	2	Fe II	340	2709.937	23	2712.87	1	Cr II	289	2712.85	UV
2709.98	5	Mn II— Fe I	18 144	2709.970 2709.989	UV	2713.04	2	Vd II	2	2713.050	UV
2710.13	1					2713.28	1				
2710.22	2	Cr I?		2710.19	28	2713.33	3	Mn I	11	2713.320	UV
2710.32	4	Mn II	18	2710.336	19	2713.44	3	Fe		2713.445	7
2710.41	4d	Mn II— Fe	18	2710.392 2710.417	19 7	2713.64	1	Fe II		2713.661	23
						2713.79	2h	Ti II Fe II?	13	2713.795 2713.819	56 10

## The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2714.07	4	Fe I	161	2714.059	7	2717.96	2				
2714.19	4	Vd II	2	2714.205	UV	2718.07	2W	Cr I	17	2718.07	UV
2714.42	7W	Fe II	63	2714.414	UV	2718.34	5	Cr II	187	2718.08	UV
2714.88	6	Fe I	48	2714.869	7	2718.44	6	Fe I	48	2718.32	UV
2715.12	3	Fe I		2715.120	7	2718.64	3	Fe II	417	2718.639	23
2715.32	4	Fe I	4	2715.320	7	2719.04	8W	Fe I - Fe I	5	2719.028	7
2715.41	4	Fe		2715.405	7			Fe I	161	2719.060	7
2715.52	3	Fe I		2715.500	7	2719.31	4	Fe II - Mn II	339	2719.296	UV
2715.65	4	Vd II	1	2715.676	UV					2719.307	19
		Vd II	1	2715.676	UV	2719.42	5	Fe I	154	2719.420	7
2715.74	2					2719.58	3	Co I	108	2719.581	UV
2716.01	4	Co I	131	2715.987	UV			Fe		2719.592	7
		Fe		2716.002	7						
2716.23	6D	Fe II - Fe I	261	2716.216	UV	2719.74	4	Mn II	33	2719.743	19
		Fe I	155	2716.258	7	2719.82	3				
2716.42	3	Fe I	154	2716.418	7	2719.91	2	Mn II		2719.895	19
		Fe II	339	2716.429	UV						
2716.69	4	Fe II	62	2716.683	UV	2720.00	2	Mn II	33	2720.003	19
2716.78	2	Mn II	33	2716.796	19	2720.07	3	Cr II	102	2720.06	UV
2716.89	1					2720.21	5	Fe I	129	2720.197	7
2717.05	1W					2720.26	3	Cr II	102	2720.25	UV
2717.13	2	Fe I		2717.134	43	2720.53	4	Fe I	4	2720.519	7
2717.31	4	Ti II	15	2717.304	UV	2720.90	7W	Fe I	5	2720.903	7
2717.36	4	Gd III		2717.357	3	2721.11	5	Fe I		2721.108	7
		Fe I	47	2717.366	7	2721.33	2W				
2717.51	5	Cr II	7	2717.51	UV	2721.64	3	Ca I		2721.645	45
		Mn II	33	2717.527	19						
		Fe II	32	2717.533	UV	2721.80	4	Fe II	199	2721.813	UV
2717.79	5	Fe I	49	2717.786	7	2722.05	5D	Fe I	97	2722.039	7
								Fe II	260	2722.060	UV

The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2722.23	3					2726.13	4	Mn I	11	2726.13	UV
2722.32	4					2726.24	5	Fe I	161	2726.235	7
2722.43	1					2726.35	2	Cr II	162	2726.26	UV
2722.60	3	Zr II	3	2722.62	UV	2726.51	5	Zr II	4	2726.48	UV
2722.74	5	Cr II	7	2722.74	UV			Cr I	7	2726.496	UV
		Fe II	416	2722.740	23			Fe II	261	2726.509	UV
2722.80	2					2726.57	2	Vd II	47	2726.544	UV
2723.02	3	Fe I	154	2723.032	29	2726.69	3				
2723.21	4	Vd II	1	2723.218	UV	2726.79	3	Fe II?		2726.809	23
2723.37	3	Fe II		2723.390	10	2726.91	1	Fe II		2726.936	10
2723.58	6W	Fe I	5	2723.578	7	2727.25	4	Cr II	102	2727.25	UV
2723.78	4					2727.39	5	Fe II—	200	2727.382	UV
		Fe II		2723.893	10			Ti I	32	2727.420	58
2723.89	2w					2727.55	7W	Fe II	63	2727.538	UV
2724.03	3d	Cr II	102	2724.04	UV	2728.03	6	Fe I	47	2728.020	7
2724.16	1h					2728.16	2	Cr II	162	2728.17	UV
2724.33	5	Fe I	144	2724.339	7	2728.23	1				
2724.43	4	Mn II	33	2724.465	19	2728.45	1H				
2724.66	4	Fe I		2724.670	7	2728.63	4	Vd II	1	2728.644	UV
2724.92	6D	Fe II	62	2724.879	UV	2728.82	5	Fe I	154	2728.820	7
		Fe I	48	2724.953	7						
2725.09	3	Ti I	32	2725.081	58	2728.91	4	Fe II	260	2728.898	UV
2725.33	5w	Fe I	98	2725.329	7	2728.97	5	Fe I	4	2728.969	7
2725.61	5	Fe I	48	2725.601	7	2729.32	1	Fe II		2729.338	23
2725.80	5	Ti II	15	2725.79	UV	2729.43	2	Fe II	220	2729.427	UV
		Fe I	161	2725.805	UV	2729.55	1	Fe II	417	2729.569	23
2725.95	3	Mn II	34	2725.932	19	2729.71	1	Cr II?	162	2729.73	UV
2726.06	6	Fe I	48	2726.055	7	2729.81	1				

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2730.02	3					2733.36	3	Fe I		2733.364	43
2730.12	3					2733.49	5	Mg I	9	2733.493	44
2730.26	3	Fe I		2730.265	29	2733.58	6W	Fe I	46	2733.581	7
2730.38	2					2733.90	3	Vd II	1	2733.906	UV
2730.50	2					2734.00	5	Fe I	48	2734.005	7
2730.73	6W	Fe II	62	2730.735	UV	2734.05	3				
2730.98	5	Fe I	48	2730.982	7	2734.27	5	Fe I	125	2734.268	7
2731.11	2	Co I	140	2731.112	UV	2734.44	4				
2731.28	4	Fe I	161	2731.281	UV	2734.62	4	Fe I	47	2734.616	7
2731.33	2	Vd I	85	2731.347	UV	2734.86	5	Zr II	4	2734.84	UV
2731.40	2					2735.01	5d				
2731.56	1	Ti I	32	2731.583	58	2735.28	4	Ti I	32	2735.283	58
2731.73	2					2735.32	3	Fe I	98	2735.319	43
2731.85	2	Fe II		2731.841	10	2735.47	6	Fe I	46	2735.475	7
		Fe I	154	2731.849	43	2735.61	5	Fe I	125	2735.612	7
2731.91	5	Cr I	7	2731.895	UV			Ti I	26	2735.613	UV
2732.00	5w	Mg I	9	2731.993	44	2736.20	4				
		Fe II	236	2732.004	UV	2736.50	6D	Cr I	7	2736.463	UV
2732.11	3							Fe II	220	2736.500	UV
2732.32	3	Fe II		2732.328	10	2736.75	5	Mg I	9	2736.542	44
2732.45	4	Fe II	32	2732.441	UV	2736.88	5				
2732.59	1					2736.97	6W	Fe I	49	2736.964	7
2732.72	2	Zr II	5	2732.72	UV			Fe II	63	2736.968	UV
2732.78	3	Fe I		2732.778	29	2737.09	2	Cr II	120	2737.09	UV
								Cr II	253	2737.09	UV
2732.90	4	-Fe II	417	2732.936	23	2737.30	6W	Fe I	5	2737.310	7
2733.18	1					2737.57	2				
2733.25	2	Ti I	32	2733.264	58	2737.63	4	Fe II	200	2737.630	UV
								Fe I	153	2737.640	7

The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2737.83	4	Fe I		2737.832	7	2741.56	4	Zr II I Fe I	5 98	2741.54 2741.577	UV 7
2738.21	3	Fe I	48	2738.214	7	2741.66	1	Fe II		2741.673	23
2738.27	2	Fe I		2738.276	43	2742.02	6	Fe I Cr II	4 6	2742.016 2742.02	7 UV
2738.45	3	Fe I?		2738.44	51	2742.15	3	Cr I	63	2742.165	UV
2738.50	2h					2742.24	6	Fe I	46	2742.254	7
2738.86	1	Mn I		2738.861	4	2742.32	5	Ti I	25	2742.297	58
2738.98	1	Fe I	95	2738.955	43	2742.40	6W	Fe I	5	2742.406	7
2739.10	2	Fe I		2739.109	43	2742.45	3	Vd II	1	2742.43	UV
2739.23	2					2742.55	3	Zr II	4	2742.54	UV
2739.56	8W	Fe II	63	2739.545	UV	2742.67	3	Vd II	13	2742.670	UV
2739.71	2	Vd II	1	2739.715	UV	2742.73	1	Mn I		2742.735	4
2739.80	2	Ti I	32	2739.808	58	2743.20	7W	Fe II	62	2743.196	UV
2740.09	5	Cr II	6	2740.09	UV	2743.56	5	Fe I	47	2743.565	7
2740.24	2h					2743.64	5	Cr II	6	2743.63	UV
2740.33	1	Zr II	12	2740.33	UV	2743.75	2h	Vd II	13	2743.768	UV
2740.44	3	Ge I Co I	23 109	2740.426 2740.457	25 UV	2743.94	2	Cr II?—	184	2743.94	UV
2740.49	1	Zr II	19	2740.49	UV	2744.06	6w	Fe I	5	2744.068	7
2740.68	3					2744.25	4	Fe II	32	2744.265	38
2740.88	4					2744.33	3				
2740.98	3					2744.52	5	Fe I	46	2744.527	7
(2741.06	3	Fe II Cr I	418 63	2741.045 2741.078	23 UV	2744.68	1	Fe II		2744.691	10
(2741.10	4	Fe I	181	2741.102	7	2744.78	2h				
2741.21	3					2744.89	3	Fe II	260	2744.890	UV
2741.36	5D	Fe I Fe II	180 260	2741.325 2741.395	43 UV	2744.96	3	Cr II	58	2744.97	UV
						2745.00	3	Fe I		2745.017	43

## The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2745.08	4	Fe I		2745.081	51	2748.24	3	Au I Cr I	4 15	2748.24 2748.275	UV UV
2745.29	1w	Fe II		2745.297	23	2748.32	3				
2745.42	1w	Cr II	185	2745.41	UV	2748.98	6	Cr II	6	2748.98	UV
2745.55	1w	Fe II Mn I		2745.534 2745.549	10 4	2749.18	7W	Fe II	63	2749.178	UV
2745.67	1	Fe II		2745.668	10	2749.32	7W	Fe II	62	2749.324	UV
2745.76	1					2749.48	6W	Fe II	63	2749.482	UV
2745.81	4	Fe I?		2745.817	51	2749.68	5	Fe I	49	2749.688	29
2745.87	3h	Zr II	3	2745.86	UV	2749.81	2	Cr II	253	2749.82	UV
2745.96	4	Fe I		2745.952	29	2750.03	5	Fe II	199	2750.003	UV
2746.00	3	Co I	108	2746.028	UV	2750.14	6W	Fe I	5	2750.140	7
2746.14	2d	Cr II Fe II	138 373	2746.15 2746.157	UV UV	2750.41	2h				
2746.21	2	Cr II	58	2746.21	UV	2750.50	1h	Fe II		2750.501	10
		Cr II	253	2746.21	UV	2750.72	6d	Fe I Cr II	125 6	2750.697 2750.72	7 UV
2746.49	7W	Fe II	62	2746.487	UV	2750.88	5d	Fe I Fe II	128 200	2750.874 2750.896	7 UV
2746.74	5	Ti II Ni II	31 26	2746.721 2746.743	56 UV	2751.05	1				
2746.98	7W	Fe II Fe I	63 45	2746.978 2746.982	UV 7	2751.12	4	Fe II	217	2751.121	UV
2747.30	1W	Fe I	179	2747.316	7	2751.19	2h				
2747.46	1	Vd II	135	2747.462	UV	2751.32	3	Fe I		2751.325	29
2747.53	5	Fe I Fe I	95 125	2747.555 2747.555	7 7	2751.59	3	Cr I	15	2751.58	UV
2747.66	3h					2751.70	1	Ti II	31	2751.70	UV
2747.77	1	Cr II	185	2747.76	UV	2751.86	6w	Cr II	6	2751.85	UV
2747.93	1h	Cr II?		2747.94	UV	2752.18	3h	Fe II-Zr II	373 3	2752.159 2752.21	UV UV
2748.16	2					2752.36	1h	Cr II	253	2752.37	UV
						2752.45	1				

## The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2752.56	1	Fe II?		2752.542	10	2756.50	4	Fe II	200	2756.504	UV
2752.68	1h					2756.59	3	Fe II		2756.622	10
2752.86	4	Cr I	15	2752.851	UV	2756.73	1w	Cr I?	79	2756.77	UV
2753.04	1	Fe II	417	2753.034	23	2756.87	3	Cr II	101	2756.89	UV
2753.10	4	Fe I		2753.098	7	2756.96	2	Cr II	100	2756.96	UV
2753.28	6	Fe II	235	2753.289	UV	2757.03	4	Fe II	199	2757.029	UV
2753.40	3w	Vd II	150	2753.407	UV	2757.08	4	Cr I	15	2757.086	UV
2753.69	5	Cr II	58	2753.66	UV	2757.32	5	Fe I	46	2757.316	7
		Cr II	101	2753.66	UV			Fe I	95	2757.422	7
		Fe I	46	2753.686	7	2757.42	4				
2753.80	4					2757.53	3	Fe I		2757.535	7
2753.86	4					2757.72	5	Cr II	6	2757.72	UV
2753.98	4					2757.86	4	Fe I		2757.858	7
2754.03	5	Fe I	47	2754.032	7	2758.08	3	Ti I	35	2758.066	58
2754.26	4H	Cr II	101	2754.28	UV	2758.23	2	Cr I	79	2758.236	UV
								Cr I	101	2758.236	UV
2754.43	4	Fe I	47	2754.426	7	2758.54	1h	Vd II	13	2758.53	UV
2754.59	4	Ge I	1	2754.588	25			Vd II	65	2758.53	UV
2754.83	3	Cr I	79	2754.821	UV	2758.80	3	Zr II	3	2758.80	UV
2754.94	5d	Fe II	373	2754.907	UV	2758.97	4	Cr II	252	2758.99	UV
		Fe I		2754.942	7	2759.18	2	Fe I		2759.174	43
2755.07	3	Fe I	153	2755.055	43	2759.32		Fe II	32	2759.336	UV
		Fe II	373	2755.088	UV						
2755.18	5	Fe I	153	2755.181	7	2759.38		Cr II	101	2759.40	UV
2755.74	8W	Fe II	62	2755.733	UV	2759.51	4	Fe II		2759.501	10
2756.08	4	Fe		2756.086	7	2759.71	4	Cr II	101	2759.73	UV
2756.31	7D	IIFe I	4	2756.267	7	2759.81	5	Fe I	47	2759.813	7
		Cr II	101	2756.30	UV						
		IIFe I	5	2756.328	7	2759.91	4				
						2760.04	3	Cr II	184	2760.04	UV

The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2760.11	3	Vd II	77	2760.122	UV	2763.08	5	Cr I	79	2763.09	UV
2760.19	3	Mg I Cr II	101	2760.170 2760.20	38 UV	2763.31	3	IIFe I	101 47	2763.09 2763.109	UV 7
2760.35	4	Cr II	100	2760.36	UV	2763.49	4	Fe II	32	2763.504	38
2760.51	3	Cr II	253	2760.53	UV	2763.57	3	Cr II	101	2763.59	UV
2760.62	4	Fe I	127	2760.623	29	2763.69	2	Fe II	440	2763.674	UV
2760.69	3	Vd II	149	2760.710	UV	2763.77	1				
2760.90	5d	Fe I Mn I Mn II	9	2760.891 2760.920 2760.92	7 UV 19	2763.90	4	Fe II	199	2763.913	UV
2761.15	1	Fe II— Fe II		2761.128 2761.178	UV 23	2764.14	5D	Fe I Mg II Fe II		2764.118 2764.137 2764.149	7 38 10
2761.28	3	Ti II	12	2761.299	56	2764.33	6w	Fe I Cr I	128 15	2764.323 2764.355	UV UV
2761.35	3	Co I	52	2761.366	UV	2764.80	5	Fe II— Ti II	198 12	2764.787 2764.821	UV UV
2761.49	3	Fe I Fe II	140	2761.480 2761.498	7 10	2764.92	2				
2761.67	1	Fe I		2761.678	43	2765.22	5	Mg I	8	2765.222	44
2761.73	7W	Cr I	15	2761.735	UV	2765.44	5d	Cr II Fe II	100 324	2765.46 2765.493	UV UV
2761.79		Fe I Fe II	46 63	2761.780 2761.813	7 UV	2765.62	4	Cr II	59	2765.62	UV
2762.02	7	Fe I	46	2762.026	7	2765.67	5	Vd II Vd II IIFe I	46 218 92	2765.676 2765.676 2765.70	UV UV UV
2762.22	3	Ti II	12	2762.22	UV						
2762.32	3	Fe II	373	2762.340	UV	2765.86	3	Cr II	260	2765.86	27
2762.44	3	Fe II	199	2762.436	UV	2766.03	3	Fe I	179	2765.991	7
2762.58	6	Cr II	6	2762.58	UV	2766.08	4	Fe I	160	2766.03	UV
2762.67	5	Fe		2762.681	7	2766.08	4	Fe I	97	2766.078	43
2762.76	5	IIFe I Cr II	125 100	2762.772 2762.78	7 UV	2766.20	4	Fe II Co I	324 131	2766.200 2766.215	UV UV
2762.90	4	Fe I		2762.890	43						

## The Echelle Solar Spectrum (Continued)

Solar			Laboratory				Solar			Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref		
2766.39	5	Cu I Co I Cr I	18 52 93	2766.371 2766.382 2766.39	UV UV UV	2769.56	3	Fe II	199	2769.566	UV		
2766.46	4	Vd II	77	2766.460	UV	2769.66	5	Fe I	44	2769.671	7		
2766.53	6	Cr II	6	2766.55	UV	2770.04	3						
2766.65	5	Fe I		2766.659	7	2770.15	2						
2766.91	5	Fe I	47	2766.910	7	2770.29	2	Fe II	337	2770.303	23		
2767.25	2	Cr II	266	2767.26	UV	2770.40	3						
2767.35	2					2770.51	5	Fe II Fe II	198 199	2770.507 2770.507	UV UV		
2767.50	6W	Fe II Fe II Fe I	235 373 46	2767.500 2767.500 2767.522	UV UV 7	2770.59	4	Fe		2770.575	7		
2767.80	2	Fe I	153	2767.813	43	2770.69	4	Fe I	123	2770.695	UV		
2767.92	1	Fe I	153	2767.940	43	2770.84	3	Fe I	3	2770.847	43		
2768.01	1					2770.97	2						
2768.10	5	Fe I		2768.105	7	2771.05	1	Fe I		2771.050	43		
2768.33	5	Fe II Mg I	338 8	2768.334 2768.339	UV 44	2771.18	4	Fe II	282	2771.184	UV		
2768.43	5	Fe I Mn II	126 83	2768.432 2768.456	UV 19	2771.30	2d	Cr II? Fe II?	251	2771.27 2771.314	UV 10		
2768.56	5	Vd II Cr II	46 252	2768.566 2768.59	UV UV	2771.55	4	Fe II	197	2771.553	UV		
2768.72	2	Zr II	4	2768.73	UV	2771.64	1	Pt I	3	2771.65	UV		
2768.84	2	Zr II Fe II	4 324	2768.84 2768.848	UV UV	2771.72	2						
2768.93	6	Fe II	63	2768.940	UV	2772.10	6d	Fe I Fe I	45 5	2772.074 2772.110	7		
2769.15	5	Fe II	200	2769.153	UV	2772.32	5	Fe I		2772.318	7		
2769.28	5	Fe I	151	2769.297	UV	2772.51	5	Fe I		2772.508	7		
2769.35	5	Fe II	198	2769.354	UV	2772.72	5	Fe II	63	2772.719	UV		

## The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2772.82	4	Fe I	179	2772.826	7	2776.69	7W	Mg I	6	2776.690	44
2773.02	2	Mn II?	46	2773.043	19	2776.77	4	Fe II		2776.783	10
2773.22	5	Fe I		2773.232	UV	2776.85	2				
2773.30	4	Cr II	58	2773.30	UV	2776.90	3	Fe II	373	2776.923	UV
2773.45	3					2777.27	2h				
2773.67	2	Fe II	338	2773.678	UV	2777.43	2				
2773.89	4	Fe I	151	2773.903	7	2777.60	3	Fe II	32	2777.587	38
2774.02	4					2777.73	4	Vd II	77	2777.748	UV
2774.16	3	Zr II   Fe I	40 127	2774.15 2774.161	UV 7	2777.84	3	Fe II	281	2777.840	UV
2774.26	3	Vd II	46	2774.28	UV	2777.89	5	Fe II	233	2777.892	23
2774.42	3	Cr II	266	2774.44	UV	2778.08	5	Cr II Fe I	266 267	2778.06 2778.067	UV 7
2774.72	5d	Fe II Fe I Fe II	218 46 32	2774.686 2774.730 2774.732	UV 7 38	2778.13	4	Mg I	7	2778.13	44
2774.93	5	Fe I Co I	179 52	2774.938 2774.960	UV 7	2778.56	4	Mn I	9	2778.544	UV
2775.22	3	Fe I		2775.233	43	2778.75	4				
2775.33	4	Fe II	32	2775.339	UV	2778.84	5	Fe I		2778.841	7
2775.44	3					2778.93	3	Fe I		2778.927	43
2775.64	3	Mn II Cr I	73 93	2775.652 2775.668	UV UV	2779.15	3	Cr I	93	2779.134	UV
2775.78	4	-Vd II	148	2775.770	UV	2779.30	6	Fe II	234	2779.302	UV
2775.84	4	Fe I		2775.844	7	2779.84	7W	Mg I  Mg I Fe II	6 6 348	2779.831 2779.831 2779.906	44 44 UV
2776.19	5	Fe II Mn I	199 9	2776.180 2776.218	UV UV	2780.02	3w	Mn I Fe II	13 348	2779.993 2780.035	4 UV
2776.42	6d	Fe I- Fe I		2776.397 2776.448	7	2780.30	4	Cr II Cr II	183 252	2780.30 2780.30	UV UV
2776.53	4	-Fe II?		2776.554	10	2780.55	5w	Ti II-	8	2780.522	56

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2780.70	5	II Cr I Fe I	15 160	2780.695 2780.698	UV 7	2784.27	4	Fe II	295	2784.282	UV
2780.88	4	Fe I Cr II	45 58	2780.883 2780.89	UV	2784.33	5	Fe I	152	2784.343	7
2781.00	4					2784.50	4h	Fe II	373	2784.484	UV
2781.05	3	Cr II	260	2781.07	UV	2784.64	4	Ti II	8	2784.648	UV
2781.15	1	Cr I	93	2781.15	UV	2784.83	4	Fe II		2784.833	10
2781.29	6	Mg I	7	2781.288	44	2785.02	5	Fe II	32	2785.024	38
2781.42	7	Mg I	6	2781.416	44	2785.12	5	Cr II Fe	99	2785.10 2785.127	UV 7
2781.84	5	Fe I	46	2781.836	7	2785.21	5	Fe II	373	2785.213	UV
2782.06	4	Fe I	126	2782.053	7	2785.34	2				
2782.15	2h	Mn II	72	2782.145	19	2785.59	2				
2782.37	3h	Cr II	183	2782.36	UV	2785.69	5	Cr II	183	2785.69	UV
2782.58	2	Cr II	257	2782.59	UV	2785.77	4	Fe II	295	2785.800	UV
2782.74	3	Mn I	7	2782.711	4	2786.17	5	Fe I	123	2786.18	UV
2782.98	7	Mg I	6	2782.972	44	2786.46	4	Cr II-	252	2786.46	UV
2783.10	4	Mn I? Fe II		2783.080 2783.095	4 10	2786.58	2			2786.781	7
2783.36	3					2786.79	5	Fe I			
2783.42	3	Fe II	337	2783.410	23	2787.12	3	Fe I	151	2787.12	UV
2783.54	4	Fe I	95	2783.551	7	2787.22	4	Fe II	380	2787.241	7
2783.70	6	Fe II	234	2783.690	UV	2787.62	5	Cr II	58	2787.61	UV
2783.85	4	Cr II Fe I	252 2783.845	2783.84 2783.845	UV 29	2787.82	4	Mn I	9	2787.813	UV
2784.00	5	Fe II Fe I	295 160	2783.959 2784.009	UV 7	2788.11	7W	Fe I	44	2788.104	7
2784.21	3	Mn II	83	2784.208	19	2788.99	2				
						2789.11	3	Cr II?	99	2789.08	UV
						2789.20	3	Mn I	8	2789.192	UV

The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2789.38	3d	Mn I	9	2789.355	UV	2797.19	2	Fe II	436	2797.215	23
		Cr II	276	2789.39	UV			Fe I	45	2797.775	7
		Cr II	327	2789.39	UV	2797.77	5				
2789.48	6	Fe I	125	2789.477	UV	2797.93	6	Fe II	234	2797.914	UV
2789.67	4	Fe II		2789.675	10	2798.02	6	Mg II	3	2797.93	38
2789.83	5D	I Fe I—Fe	170	2789.802	7	2798.26	6	Mn I	1	2798.270	46
				2789.847	7			Cr II		2798.65	UV
2789.95	4	Mn II	72	2789.982	19	2798.65	5	II Ni I	26	2798.651	UV
2790.33	3d	Mn I	8	2790.353	UV	2798.76	3	Vd II	100	2798.755	UV
2790.56	3d	Mg II		2790.542	38			Cr II	117	2798.77	UV
		Fe II	282	2790.557	UV	2799.15	4	Fe I		2799.146	7
2790.77	7	Fe II	32	2790.752	UV	2799.30	3h	Fe II	233	2799.292	23
		I Mg II	3	2790.776	46						
2790.98	4d	Fe I?—Fe II	160	2790.942	43	2799.47	2	Vd II	62	2799.451	UV
			232	2791.001	UV	2799.84	4w	Mn I	6	2799.841	UV
2791.09	2	Mn I	6	2791.085	UV	2800.47	3	Fe I		2800.467	7
		Mg II		2791.117	38						
2791.20	2					2800.77	2	Cr II	182	2800.77	UV
2791.45	4	Fe I		2791.454	7	2801.08	6	Mn I	1	2801.084	UV
2791.51	4					2801.28	3				
2791.79	5	Fe I	151	2791.786	UV	2802.70		Mg II	1	2802.704	46
2792.16	2	Cr II	183	2792.16	UV	2803.18	4	Fe I	3	2803.166	7
2792.39	5	Fe I	95	2792.399	7	2803.61	3	I Fe I	151	2803.613	UV
								Mn I	8	2803.623	4
2793.89	4	Fe II	198	2793.887	UV	2804.52	5	Fe I	44	2804.521	7
2794.69	3	Fe I	46	2794.702	7	2804.86	3h	Fe I	170	2804.862	7
2794.82	6	Mn I	1	2794.817	UV			Fe I	151	2804.883	43
2795.00	4	Fe I	3	2795.005	7	2805.07	4	Ni I	1	2805.078	UV
2795.53		Mg II	1	2795.528‡	46	2805.37	2	Mn II	66	2805.364	19
2796.87	2	Fe I	96	2796.871	UV	2805.81	3	Fe II	259	2805.786	UV
								Fe I	92	2805.808	UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2806.08	3	Fe I	139	2806.070	7	2810.99	2				
2806.29	2W					2811.08	2	Mg I		2811.112	44
2806.48	2h	Ti II? Fe II?	176	2806.495 2806.500	56 43	2811.16	3	Fe I Cr I	92 54	2811.162 2811.169	7 UV
2806.68	2h					2811.28	3	Fe II Mn II	196 51	2811.269 2811.283	UV 19
2806.99	5	Fe I	45	2806.984	7	2811.59	1	OH	(1-0)	2811.591	8
2807.08	3	Fe I	90	2807.073	43	2811.69	2				
2807.19	3H	Fe II Fe II	295 281	2807.165 2807.165	UV UV	2811.80	3	Mg I OH	(1-0)	2811.781 2811.797	44 8
2807.24	4	Fe I	2	2807.245	7	2812.02	5	Cr II	182	2812.00	UV
2807.88	3					2812.02	5	Cr II Fe I	257 170	2812.00 2812.042	UV UV
2808.00	2h	Mn I Cr II	6	2808.015 2808.02	UV UV	2812.16	1	OH	(1-0)	2812.162	8
2808.34	4d	Fe I— Ni II?	45 26	2808.327 2808.343	7 52	2812.23	3d	-Mn II	71	2812.264	19
2808.64	3	Fe I		2808.665	29	2812.31	4	Fe I	96	2812.31	UV
2808.81	2	Fe I		2808.79	51	2812.50	4	Fe II	215	2812.493	UV
2808.94	2					2812.60	3	Mn II OH	71 (1-0)	2812.588 2812.591	19 8
2809.12	3	Mn I	6	2809.103	UV	2812.84	3	Mn I	8	2812.840	UV
2809.77	3D	Mg I Fe II	380	2809.761 2809.804	44 UV	2812.93	3h				
2810.15	2	Vd II	120	2810.158	UV	2813.07	4				
2810.22	3	Mn II	71	2810.247	19	2813.16	4				
2810.28	5	Vd II Ti II	120 25	2810.272 2810.276	UV UV	2813.29	6	Fe I	44	2813.287	7
2810.42	3					2813.47	3	Mn I	8	2813.489	4
2810.67	1w					2813.62	4	Fe II	198	2813.613	UV
2810.84	4	Fe I Co II		2810.834 2810.859	29 18	2813.77	2	OH	(1-0)	2813.776	8
						2813.99	2	Mn I	7	2813.989	UV

## The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2814.20	1w	Fe I	176	2814.210	43	2817.50	5	Fe I	44	2817.504	7
2814.37	3	Ni I	79	2814.354	UV	2817.57	2	OH	120	2817.506	UV
2814.54	2h	Cr I	100	2814.52	UV	2817.63	3		(1-0)	2817.580	8
2814.67	1h	Fe I	176	2814.678	43	2817.77	3w				
2814.89	2h	Zr I	4	2814.91	UV	2817.88	2	Ti I	29	2817.835	58
2815.01	4	Fe I	138	2815.014	7	2815.025	19	Ti II	25	2817.838	UV
2815.34	3h	OH	(1-0)	2815.368	8	2817.96	5	Cr II	182	2817.96	UV
2815.53	5	Fe I— Co I	95 52	2815.508 2815.555	UV	2818.07	1	W I?	14	2818.060	UV
2815.84	2w	Fe I		2815.836	29	2818.36	4	Cr II	182	2818.36	UV
2816.00	4	OH	(1-0)	2815.989	8	2818.49	1	Cr I	75	2818.47	UV
		OH	(1-0)	2816.024	8	2818.59	3h	Co I	2	2818.592	UV
2816.16	3	Mo II	4	2816.153‡	UV	2816.185	26	2818.68	2	OH	(1-0)
		Al II	7					2818.76	4	Mn I—	8
2816.35	4	Mn II	51	2816.329	19			2818.90	3h	—Mn I?	8
2816.44	1	OH	(1-0)	2816.423	8			2818.97	1h		
2816.54	1	OH	(1-0)	2816.549	8			2819.14	3	OH	(1-0)
2816.68	4d	Fe I?		2816.67	51	Cr II		2819.14	3	OH	(1-0)
		Cr I	75	2816.684	UV			2819.30	5D	Fe I	170
2816.77	4							2819.30	Fe II	196	2819.327
2816.82	3	Cr II	58	2816.83	UV	2819.44	4	Fe I		2819.462	29
		Cr II	81	2816.83	UV	2819.60	2	Fe II		2819.589	23
2816.97	2d	Cr I	76	2816.95	UV	2819.73	3h				
		Cr II?	307	2817.00	UV						
2817.04	2	Yt III	3	2817.037‡	13	2819.80	4	OH	(1-0)	2819.822	8
2817.10	2h	Fe II	380	2817.107	UV	2820.00	3w	Co I	1	2820.002	UV
2817.24	2							Co I	109	2820.002	UV
2817.35	3d	OH— OH	(1-0)	2817.319	8	2820.19	4	Fe I		2820.20	51
			(1-0)	2817.380	8	2820.36	4	Ti II	7	2820.36	UV

The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2820.50	4	OH	(1-0)	2820.501	8	2823.99	3	Fe II?		2824.007	10
2820.67	3	OH	(1-0)	2820.669	8	2824.12	1h	OH	(1-0)	2824.096	8
2820.80	5	Fe I	2	2820.803	7	2824.23	2	Fe II?		2824.213	10
2820.92	3					2824.37	4	Cu I	17	2824.370	UV
								OH	(1-0)	2824.393	8
2821.00	4	Fe I?		2821.009	51	2824.45	1	Ir I	5	2824.448	UV
2821.12	2	Vd II	86	2821.124	UV	2824.53	2	Cr II?		2824.54	UV
2821.29	6	Ni I	25	2821.291	UV	2824.61	3	Fe II	399	2824.589	UV
2821.45	3	Mn I	6	2821.452	UV	2824.69	4	Fe I	170	2824.700	7
		Mn I	6	2821.452	UV						
2821.54	2					2824.84	1				
2821.63	4	Fe I	134	2821.63	UV	2824.93	1	Fe I	169	2824.946	43
2821.71	2	OH	(1-0)	2821.706	8	2825.14	1	Co I?		2825.15	50
2821.88	4	Fe I?		2821.88	51	2825.22	4	Ni II?	25	2825.231	52
								Co II		2825.245	18
2822.02	4	Cr II	182	2822.01	UV	2825.31	3				
2822.16	2					2825.47	4	Cr II	83	2825.50	UV
2822.26	1					2825.56	6	OH	(1-0)	2825.545	8
2822.37	5	II Cr II	82	2822.38	UV	2825.68	6	Fe I	45	2825.556	7
		OH	(1-0)	2822.404	8						
2822.55	4	Mn I	6	2822.549	UV	2825.75	4	Fe I	3	2825.687	7
2822.68	4h	Fe II	231	2822.668	UV	2825.80	2	Fe II	195	2825.747	UV
		OH	(1-0)	2822.705	8						
2822.80	4	OH	(1-0)	2822.787	8	2826.01	5d	Fe I	3	2825.994	7
								Fe II	255	2826.024	UV
2823.13	1					2826.14	3	Cr II	182	2826.15	UV
2823.29	6w	Fe I	44	2823.276	7	2826.31	2	Fe I		2826.329	43
2823.50	3	Fe I		2823.507	43	2826.36	1				
2823.65	1d					2826.48	4	Fe I	92	2826.497	7
2823.74	1h					2826.66	3	OH	(1-0)	2826.674	8

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2826.73	2w	Cr I	100	2826.734	UV	2830.32	3	Pt I OH	1 (1-0)	2830.29 2830.339	UV 8
2827.06	4	Fe I?		2827.09	51	2830.46	5	Cr II	82	2830.46	UV
2827.11	1	Ti I?		2827.109	58	2830.60	4	Cr II	81	2830.60	UV
2827.24	1h					2830.77	4D	Fe I Mn I Mn I	6 6	2830.754 2830.793 2830.793	29 UV UV
2827.41	5	Fe II	231	2827.431	UV	2830.94	5	Fe II	280	2830.939	UV
2827.57	5	Fe I		2827.590	43	2831.04	2W	Cr I	88	2831.039	UV
2827.66	3	Fe I	169	2827.67	UV	2831.56	5	Fe II	217	2831.562	UV
2827.74	1					2831.84	3	OH	(1-0)	2831.838	8
2827.88	6	Fe I	3	2827.892	7	2831.99	1W	Fe I	170	2831.978	43
2828.05	3					2832.19	5	Ti II OH	7 (1-0)	2832.178 2832.222	56 8
2828.15	1	Ti II— Cr I	25 54	2828.150 2828.167	UV UV	2832.28	3	Fe II	347	2832.270	UV
2828.25	3	Fe I?		2828.26	51	2832.45	6W	Fe I Cr II	44 195	2832.436 2832.45	7 UV
2828.44	3					2832.65	1				
2828.58	3					2832.87	2h				
2828.65	5D	Fe II— Fe II	231 255	2828.622 2828.681	UV UV	2833.08	3h	Pb I Fe II	1 380	2833.060 2833.100	UV 23
2828.80	5	OH Fe I	(1-0) 45	2828.784 2828.808	8 UV	2833.31	3				
2828.98	2D	OH	(1-0)	2828.984	8	2833.40	5	Fe I	137	2833.401	UV
2829.28	4	OH	(1-0)	2829.277	8	2833.49	2				
2829.36	3	OH	(1-0)	2829.373	8	2833.84	5	OH	(1-0)	2833.843	8
2829.47	2	Fe I		2829.485	29	2833.94	2	Co I	2	2833.922	UV
2829.58	2					2834.02	2d	Ti I?— Fe I?	176	2834.002 2834.050	58 43
2829.86	2	OH	(1-0)	2829.879	8	2834.17	5	OH— Fe I	(1-0) 93	2834.172 2834.173	8 7
2830.06	3d	Fe II OH	259 (1-0)	2830.061 2830.095	UV 8						
2830.25	2	Cr II	182	2830.24	UV						

## The Echelle Solar Spectrum (Continued)

Solar			Laboratory				Solar			Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref		
2834.23	4	Cr II	195	2834.24	UV	2837.04	4						
2834.42	4	Fe I	92	2834.413	7	2837.14	1	OH	(1-0)	2837.134	8		
		Fe I	90	2834.419	7			Co I	137	2837.154	UV		
2834.54	5	Ni I	2	2834.547	UV	2837.20	2	Fe I		2837.212	43		
2834.62	2	OH	(1-0)	2834.630	8	2837.30	4	Zr I	4	2837.23	UV		
2834.74	4	Fe I	159	2834.754	7	2837.73	1	Fe II	231	2837.300	UV		
2834.87	1	Fe I	154	2834.886	43	2837.87	4	Al I	13	2837.856	14		
2834.94	2	Co II?		2834.947	18			Cr II	81	2837.88	UV		
2835.00	1	Fe II?		2835.006	38	2837.96	2	Al I	13	2837.963	14		
2835.07	1					2838.12	6	Fe I	44	2838.119	7		
2835.14	1					2838.24	4	Fe II	380	2838.235	UV		
2835.26	4	Cr I?	55	2835.242	UV	2838.33	1						
2835.38	4					2838.45	4	Fe		2838.448	7		
2835.45	6	Fe I	2	2835.456	7	2838.62	1h	Os I	12	2838.626	UV		
2835.53	5	OH	(1-0)	2835.530	8	2838.79	3	Cr II	250	2838.78	UV		
2835.63	6	Cr II	5	2835.63 ‡	UV	2838.96	4	Ni I	68	2838.951	UV		
								OH	(1-0)	2838.984	8		
2835.72	6	Fe II	216	2835.716	UV	2839.00	4	Cr I	54	2839.013	UV		
2835.94	5	Fe I	93	2835.950	7	2839.22	4d	Cr II		2839.23	UV		
2836.04	1							OH	(1-0)	2839.234	8		
								OH	(1-0)	2839.234	8		
2836.17	4w	Fe II	294	2836.185	UV	2839.32	1	Zr II	38	2839.34	UV		
2836.31	5	Mn I	6	2836.310	UV								
		Fe I	175	2836.315	UV	2839.45	2h	OH	(1-0)	2839.450	8		
		OH	(1-0)	2836.320	8								
2836.44	4	Fe I?		2836.41	51	2839.51	3	Fe II	391	2839.535	UV		
		Cr II	214	2836.47	UV	2839.63	1w						
2836.50	5	Fe II	294	2836.509	UV	2839.80	4	Fe II	380	2839.819	UV		
		Vd II	61	2836.527	UV								
2836.72	2	C II-	13	2836.710	37	2840.02	5	Cr II	82	2840.01	UV		
		OH	(1-0)	2836.736	8								
2836.82	1												

The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2840.17	3	Al I	13	2840.205	14	2843.95	6D	Fe I	2	2843.920	7
2840.35	5	Fe II	195	2840.342	UV	2844.31	1	Fe I	44	2843.977	7
2840.43	6	Fe I	2	2840.422	7	2844.44	1H	OH	(1-0)	2844.304	8
2840.66	5	II Fe II OH	217 (1-0)	2840.644 2840.681	UV 8	2844.58	3	OH	(1-0)	2844.479 2844.581	38 8
2840.76	5	Fe II	280	2840.756	UV	2844.75	2	OH	(1-0)	2844.750	8
2840.89	3	Cr I	88	2840.891	UV	2844.85	1				
2840.94	4	Fe I	123	2840.937	7	2844.98	1h	Fe II	399	2844.973	UV
2841.03	3	Vd II	61	2841.039	UV	2845.25	2h	Vd II?	160	2845.241	UV
2841.16	2					2845.39	4	Fe II	294	2845.392	UV
2841.26	3	Fe I		2841.260	29	2845.60	6	Fe I	43	2845.594	7
2841.36	4	Fe II	196	2841.354	UV	2845.72	5	Fe I	58	2845.714	UV
2841.51	4	OH	(1-0)	2841.481	8	2845.82	3				
2841.94	6	Ti II	7	2841.914	UV	2845.92	3	Ti I		2845.938	58
2842.08	4	Fe II	196	2842.076	UV	2846.03	1	Cr I	99	2846.024	UV
2842.33	4	Si I	82	2842.334	37	2846.30	1	Cr II	296	2846.32	UV
2842.41	3					2846.41	2h				
2842.66	4D	OH Fe II	(1-0) 279	2842.635 2842.677	UV	2846.46	4	Cr II OH	250 (1-0)	2846.44 2846.461	UV 8
2842.76	3	Cr II	250	2842.78	UV	2846.72	6	Mg I	5	2846.716	44
2842.90	4					2846.83	5	Fe I	87	2846.830	UV
2843.06	1					2846.98	3	Mg II		2846.952	38
2843.25	7W	Cr II OH Fe II	5 (1-0) 231	2843.24 2843.294 2843.323	UV 8 UV	2847.22	4	Fe II	187	2847.208	UV
2843.48	4	Fe II	294	2843.485	UV	2847.46	2				
2843.63	5	Fe I	43	2843.631	7	2847.57	3D				
2843.79	5										

## The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2847.77	4	OH Fe II	(1-0) 380	2847.771 2847.791	8 UV	2855.44	2	OH Fe I	(1-0) 136	2855.450 2855.450	8 43
2847.94	3					2855.67	6	Cr II Fe II	5 196	2855.67 2855.676	UV UV
2848.07	5D	Fe II— Fe II	196 399	2848.046 2848.106	UV 7	2855.86	3	OH?	(1-0)	2855.859	8
2848.21	2	Mo II	4	2848.238	UV	2856.04	1				
2848.35	6W	Fe II Mg I	391 5	2848.332 2848.342	UV 44	2856.14	5	Fe II	195	2856.144	UV
2848.53	2	Zr I	6	2848.50	UV	2856.33	3	Cr II	81	2856.32	UV
2848.72	6	Fe I	43	2848.714	7	2856.38	4	Fe II	380	2856.392	UV
2848.92	3	Fe II	317	2848.899	UV	2856.56	1	OH?	(1-0)	2856.559	8
2849.06	2	Vd II	61	2849.055	UV	2856.61	2	Ti II	20	2856.616	UV
2849.36	3W	Cr II	81	2849.33	27	2856.76	5	Cr II	11	2856.77	UV
2849.60	5	Fe II	196	2849.601	UV	2856.91	3	Fe II	399	2856.928	UV
2849.84	7	Cr II	5	2849.83	UV	2857.00	1	Fe I?		2856.99	51
2851.08	1	Ti II	16	2851.087	UV	2857.18	4	Fe II Fe I	294 123	2857.171 2857.20	UV UV
2851.35	4	Cr II	82	2851.35	UV	2857.40	5	Cr II Fe II	11 195	2857.40 2857.415	UV UV
2851.64	6	Mg I	5	2851.660	44	2857.49	1				
2851.79	6	Fe I	44	2851.797	7	2857.61	2				
2852.13		Mg I	1	2852.127‡	44	2857.80	4	Ti II Fe I		2857.801 2857.810	56 7
2853.52	2					2857.98	4	OH Fe I	(1-0)	2857.974 2857.996	8 29
2853.67	2	Fe I	88	2853.684	7	2858.08	3				
2853.75	4	Fe I	159	2853.772	7	2858.18	1				
2853.92	4	Ti II Cr I	7 54	2853.922 2853.94	UV UV	2858.33	5	Fe II Fe II	195 279	2858.340 2858.340	UV UV
2855.07	3	Cr II	214	2855.05	UV	2858.40	4	Ti II	6	2858.399	UV
2855.28	2W	Vd I— Vd II	6 83	2855.252 2855.298	UV UV	2858.52	2	Fe II	354	2858.519	UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2858.65	5	Fe II Cr II	399 11	2858.639 2858.64	UV UV	2863.44	5	Fe I	87	2863.429	UV
2858.91	6	Fe I Cr II	2 5	2858.896 2858.91	UV	2863.55	2	OH?	(1-0)	2863.536	8
2859.45	3	Fe I?		2859.48	51	2863.71	4	[Ni II OH	26 (1-0)	2863.699 2863.720	52 8
2859.58	1					2863.87	6	Fe I	2	2863.864	7
2859.65	2	Co I	52	2859.654	UV	2864.12	2	Fe II	380	2864.134	UV
2859.78	2	OH	(1-0)	2859.777	8	2864.29	1	[Fe II Vd I	195 6	2864.367 2864.386	UV UV
2859.98	1	Vd I	6	2859.997	UV	2864.37	3	Vd II?	158	2864.517	UV
2860.20	3	Fe I		2860.206	29	2864.51	1				
2860.41	2h					2864.63	1w	Fe II	294	2864.968	UV
2860.61	3	OH	(1-0)	2860.615	8	2864.98	3				
2860.94	5	Cr II	5	2860.92	UV	2865.03	2				
2861.17	4	Fe II	61	2861.187	23	2865.11	6	Cr II	5	2865.10	UV
2861.31	3	Ti II~	16	2861.291	UV	2865.34	4	Cr II	11	2865.34	UV
2861.68	1	Hf II	10	2861.695	5	2865.45	3	Fe II	391	2865.473	UV
2861.89	2	Fe II	280	2861.903	UV	2865.50	4	Ni I	26	2865.498	UV
2861.99	3	Ti II Fe I		2861.984 2861.996	56 29	2865.61	1	Zr II	10	2865.61	UV
2862.03	3	OH	(1-0)	2862.035	8	2865.67	2	OH	(1-0)	2865.668	8
2862.32	4	Ti II	16	2862.34	UV	2865.88	3	Cr II	265	2865.87	UV
2862.49	6	Fe I	43	2862.494	7	2866.15	1	Fe I		2866.150	43
2862.57	6	Cr II	5	2862.57	UV	2866.23	3	OH	(1-0)	2866.237	8
2862.73	2					2866.38	3h	Fe I	168	2866.385	29
2862.91	1h					2866.63	5	Fe I	43	2866.625	7
2863.07	3h					2866.74	6	Cr II	5	2866.72	UV
2863.30	1	Sn I	1	2863.324	UV	2867.09	5	Cr II	11	2867.09	UV
						2867.31	4	Fe I	93	2867.309	7

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2867.37	1					2870.43	5	Cr II	11	2870.43	UV
2867.57	5	Fe I	90	2867.561	7	2870.56	1	Vd I	6	2870.575	UV
2867.64	6	Cr II	5	2867.65	UV	2870.60	3	Fe II	195	2870.608	UV
2867.88	3	Fe I	91	2867.879	7	2870.77	1				
2867.93	1					2871.06	4	Fe II	195	2871.059	UV
2868.04	2	Fe II	256	2868.046	UV	2871.12	4	Fe II	230	2871.125	UV
2868.15	2					2871.21	1	Co II		2871.221	18
2868.21	4	Fe I	142	2868.214	7	2871.31	1	Fe I	174	2871.31	UV
2868.45	4	Fe II	353	2868.446	UV	2871.44	2	Cr II	295	2871.45	UV
		Fe I	135	2868.453	7	2871.50	2	Mo II	4	2871.506	UV
		Fe I	174	2868.453	7						
2868.58	2	OH	(1-0)	2868.581	8	2871.62	3	Cr I	12	2871.628	UV
2868.74	4	ITi II Ni I	5 76	2868.732 2868.739	UV	2871.72	3	Fe I	149	2871.73	UV
2868.87	5	Fe II	61	2868.874	UV	2871.98	3	OH	(1-0)	2871.987	8
2868.97	2	Fe II?		2869.001	10	2872.35	6w	OH	(1-0)	2872.324	8
								Fe I	43	2872.334	7
								Fe II	230	2872.382	UV
2869.04	2							Co I	107	2872.497	UV
2869.15	3	Fe II	257	2869.156	UV	2872.50	3	Fe I	177	2872.499	7
2869.23	3	Fe		2869.230	7	2872.58	2	Mn I	5	2872.583	UV
2869.30	6	Fe I	2	2869.308	7	2872.67	1h				
2869.39	3					2872.79	1				
2869.68	3w	Fe II	257	2869.694	UV	2872.92	2	Mn II		2872.935	19
2869.82	4	Fe I	142	2869.826	7	2872.98	1				
2869.91	3	OH	(1-0)	2869.913	8	2873.17	2	Cr I	60	2873.181	UV
2869.96	3	Vd II	12	2869.957	UV	2873.40	4	Fe II	279	2873.399	UV
2870.09	3	Mn II		2870.085	19	2873.46	5	ICr II Cr II	5 295	2873.46	UV
2870.16	1	Cr I	55	2870.175	UV	2873.59	3			2873.46	UV

The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2873.65	3	Fe I	158	2873.653	7	2877.29	5	Fe I	86	2877.301	7
2873.81	4	Cr II	11	2873.81	UV	2877.42	5	Ti II	14	2877.418	UV
2874.06	2w	Fe I	168	2874.028	43	2877.52	1	OH	(2--1)	2877.502	8
2874.17	6	Fe I	14	2874.08	UV	2877.68	2	Vd II	82	2877.689	UV
		Fe I	2	2874.172	7	2877.97	6	Cr II	5	2877.97	UV
2874.24	3	Ga I	1	2874.235	21	2878.44	5	Cr II	5	2878.45	UV
2874.32	3					2878.63	4				
2874.44	2d					2878.67	4	Fe I	142	2878.669	43
2874.61	2					2878.73	4	OH	(1-0)	2878.733	8
2874.85	5	Fe I	142	2874.881	7	2878.73	4	Fe I		2878.762	29
2875.00	3	Ru I	1	2874.984	UV	2878.88	3	OH	(1-0)	2878.885	8
		Cr II	265	2875.03	UV	2878.95	4	Fe I	90	2878.952	7
2875.07	1h					2878.95	4	Ni I	76	2878.998	UV
2875.30	6D	Fe I	86	2875.302	7	2879.10	3	OH-	(2-1)	2879.093	8
		Fe II	258	2875.342	UV	2879.15	5	Vd II	12	2879.158	UV
2875.50	2	OH	(1-0)	2875.513	8	2879.26	5	Fe II	278	2879.241	UV
2875.66	3	Vd II	12	2875.687	UV	2879.46	5	Cr I	12	2879.27	UV
2875.82	1	Ti II?		2875.8	UV	2879.46	5	Fe I	136	2879.457	7
2875.98	5	Cr II	11	2875.97	UV	2879.54	2	Mn II	61	2879.482	19
		Zr I	4	2875.98	UV	2879.54		Fe II	230	2879.543	UV
2876.07	3	Ni I	25	2876.090	UV	2879.61	1	Co I		2879.612	50
2876.25	6	Cr II	5	2876.24	UV	2879.72	3	Fe I		2879.741	29
2876.31	4	Cr II	288	2876.30	UV	2879.83	3	Mn II	69	2879.847	19
								Fe II	293	2879.849	UV
2876.53	4	OH	(1-0)	2876.564	8	2880.03	6	Vd II	12	2880.026	UV
2876.65	1	Cr II	263	2876.66	UV	2880.31	2	Ti II	20	2880.28	UV
2876.70	3	Fe I		2876.725	29	2880.59	5	Fe I	43	2880.579	7
2876.79	4	Fe II	257	2876.804	UV	2880.75	6	Cr I	13	2880.62	UV
2876.92	2							Fe II	61	2880.750	UV

The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2880.85	6	Fe II Cr II	258 11	2880.828 2880.86	UV	2885.92	4	OH OH- Fe II	(1-0) (1-0) 317	2885.911 2885.911 2885.929	8 8 UV
2881.12	3	Mn II Cr I	60 60	2881.122 2881.14	19 UV	2886.03	3	Ti I?		2886.036	58
2881.58	8 w	Si I	43	2881.579	37	2886.24	4	Fe II	229	2886.234	UV
2882.50	6	Vd II	12	2882.493	UV	2886.31	5	Fe I	87	2886.316	UV
2882.63	3	Fe I		2882.634	29	2886.44	4	Co I	1	2886.444	UV
2882.84	4d	OH OH	(1-0) (2-1)	2882.833 2882.871	8 8	2886.67	4	Mn II	60	2886.671	19
2883.10	1h					2886.99	5	Cr I	12	2886.995	UV
2883.46	2h	Au I	6	2883.45	UV	2887.14	4	Fe I?		2887.154	51
2883.65	4					2887.34	5D	Fe II Fe I	257 150	2887.312 2887.358	UV 7
2883.72	6w	OH Fe II Fe I	(1-0) 230 167	2883.686 2883.709 2883.748	8 UV UV	2887.45	3	Ti II	14	2887.456	UV
2883.94	1	OH	(2-1)	2883.935	8	2887.82	6	Fe I	167	2887.805	7
2884.10	5	Ti II	14	2884.099	UV	2887.86	4	-Mn II	61	2887.888	19
2884.14	1	Mn II	60	2884.162	19	2887.97	5	Fe I OH	149 (2-1)	2887.956 2887.977	7 8
2884.27	1	Fe II	442	2884.282	23	2888.03	4				
2884.39	1h					2888.10	5	Fe II	215	2888.089	UV
2884.65	2	OH	(2-1)	2884.671	8	2888.24	3	Vd II	82	2888.244	UV
2884.78	5	Vd II Vd II	12 82	2884.776 2884.776	UV UV	2888.38	2	Cr I	13	2888.38	UV
2884.84	1	OH	(2-1)	2884.845	8	2888.50	3				
2885.14	2	Mn II	69	2885.131	19	2888.64	1	Ti II		2888.62	UV
2885.35	4	Fe I?		2885.344	51	2888.73	3	Cr II Fe II	238 317	2888.73 2888.736	UV UV
2885.51	2					2888.94	5	Ti II	5	2888.923	UV
2885.55	1w					2889.00	3	Fe II- OH	229 (2-1)	2888.988 2889.021	UV 8
2885.81	2	OH	(2-1)	2885.811	8						

## The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2889.20	6	Cr II Cr I	11	2889.19 2889.219	UV 28	2891.67 2891.72	6 3	Vd II Fe I Fe I	12 158 183	2891.636 2891.688 2891.707	UV 7 7
2889.28	5	Cr I	12	2889.294	28	2891.86	3	Cr II	291	2891.87	UV
2889.53	5d	Cr II IMn II	207 60	2889.50 2889.520	UV 19	2891.90	4	Fe I		2891.905	7
2889.62	6	Mn II IVd II	60 12	2889.600 2889.614	19 UV	2892.07	1				
2889.81	4	Cr II	160	2889.82	UV	2892.23	3	Fe II Co I	308	2892.215 2892.242	UV 50
2889.89	6	Fe I Fe I	168 149	2889.864 2889.901	7 7	2892.44	6D	Mn II Vd II Fe I	61 12 142	2892.389 2892.434 2892.478	19 UV 7
2890.00	5	Fe I	142	2889.989	7	2892.66	6	Vd II	12	2892.650	UV
2890.15	2	OH? Cr I	(2-1) 74	2890.142 2890.16	UV	2892.72	2	Fe I?	136	2892.687	43
2890.35	1	Cr I?	13	2890.35	UV	2892.82	5	Fe II	61	2892.822	UV
2890.42	3	Fe I Co II?		2890.414 2890.428	29 18	2892.94	2	Cr II	160	2892.95	UV
2890.46	2	OH	(2-1)	2890.474	8	2893.17	1	OH- OH	(2-1) (2-1)	2893.155 2893.194	8 8
2890.57	3	OH	(1-0)	2890.560	8	2893.28	6D	Cr I- Vd II	12 12	2893.254 2893.314	UV UV
2890.67	2	Fe II?		2890.687	10	2893.46	4D	OH Fe I?	(2-1)	2893.423 2893.43	8 51
2890.75	1	Cr I	74	2890.738	UV	2893.46		OH OH	(1-0) (1-0)	2893.492 2893.492	8 8
2890.86	5	Fe I	184	2890.856	7	2893.76	3	Fe I	43	2893.763	7
2891.06	6	Cr II ITi II	240 5	2891.06 2891.066	UV 56	2893.88	4	Fe I	88	2893.881	7
2891.20	3	Cr II	238	2891.20	UV	2894.07	2	Fe II	293	2894.058	UV
2891.28	3	OH	(1-0)	2891.292	8	2894.18	3	Cr I	12	2894.168	UV
2891.35	3	Mn II	69	2891.332	19	2894.26	2	Cr II	288	2894.24	UV
2891.39	4	Cr II Fe I Cr I	194 89 60	2891.40 2891.404 2891.42	UV 7 UV	2894.30	1	OH	(2-1)	2894.303	8

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2894.42	2D	Cr II— Mo II	160 4	2894.40 2894.446	UV UV	2897.75	4	Cr II Fe II	159 323	2897.73 2897.744	UV UV
2894.50	5	Fe I	134	2894.504	7	2897.91	1W	Pt I	6	2897.89	UV
2894.63	1	Mn I	20	2894.625	UV	2898.10	3	OH	(2-1)	2898.117	8
2894.79	4	II Fe II Cr II	230 160	2894.776 2894.81	UV 27	2898.22	2	OH	(2-1)	2898.212	8
2894.90	2	Mn II	61	2894.901	19	2898.35	5	Fe I		2898.351	7
2895.05	6d	Cr II I Fe I Fe II	160 87 257	2895.02 2895.035 2895.071	UV UV UV	2898.53	4	Cr II	95	2898.53	UV
2895.22	4	Fe II	294	2895.215	UV	2898.86	4	Fe I		2898.857	7
2895.28	2					2899.15	2	Cr II	240	2899.15	UV
2895.66	1	Cr I	74	2895.675	UV	{ 2899.21	3	I Cr I Vd I	12 5	2899.203 2899.207	UV UV
2895.78	2	Ti II	1	2895.776	58		2899.24	2	Nb II	14	2899.230
2895.98	2H	—OH	(2-1)	2895.986	8	{ 2899.42	6	OH I Fe I	(1-0)	2899.399 2899.415	8 7
2896.05	1	Cr I	74	2896.064	UV		2899.46	4	Cr II	159	2899.48
2896.21	5	Vd II	11	2896.198	UV	2899.59	1	Vd I	5	2899.602	UV
2896.31	3	Cr II	159	2896.31	UV	2899.69	2	Cr I	87	2899.68	UV
2896.46	3	Cr II Cr II	159 288	2896.45 2896.45	UV UV	2899.81	1	Co I	136	2899.819	UV
2896.59	3w	OH Fe I	(2-1)	2896.575 2896.595	8 29	2899.92	1				
2896.75	4	Cr II Cr I	97 12	2896.74 2896.756	UV UV	2900.16	4	Mn II	69	2900.154	19
2897.05	4	Mn II	50	2897.068	19	2900.22	4	OH Cr I	(2-1) 13	2900.225 2900.25	8 UV
2897.26	4	Fe II	254	2897.264	UV	2900.45	3				
2897.44	1					2900.54	2	Mn I	20	2900.545	UV
2897.67	4w	Fe I Cr II	142 212	2897.637 2897.67	7 UV	2900.88	1	OH	(2-1)	2900.958	8
						2900.95	4				

## The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2901.00	4	Cr II	97	2901.00	UV	2904.29	3	OH	(2-1)	2904.298	8
2901.10	1					2904.46	1	Fe I	182	2904.478	43
2901.38	5	Fe I	89	2901.380	7	2904.52	3	Fe I		2904.522	29
2901.51	4	OH	(1-0)	2901.522	8	2904.67	2	Cr I	87	2904.674	UV
		OH	(1-0)	2901.522	8	2904.75	1	Gd III		2904.726	3
2901.57	3	Fe I		2901.587	43	2904.99	2				
						2905.20	3w	Fe II—Zr II	255 37	2905.185 2905.22	UV
2901.80	4	Fe I	91	2901.811	43	2905.37	4	Fe I		2905.376	51
2901.91	5	Fe I	142	2901.910	UV	2905.49	4	Cr I	12	2905.477	UV
2901.96	4	Ti II	1	2901.94	47	2905.66	1	Fe I?		2905.655	58
		Fe I	149	2901.976	43	2905.77	3	—Si II	17	2905.692	37
2902.04	2	Fe II	293	2902.056	UV	2905.75	3	Fe I	182	2905.57	UV
2902.18	2	Mn I	5	2902.203	UV	2906.12	4	Fe II	215	2906.120	UV
		Mn I	20	2902.203	UV	2906.45	6	Vd I	5	2906.134	UV
2902.30	3	Fe II	257	2902.317	UV	2906.60	4	Cr II	227	2906.17	UV
2902.46	4	Cr I	13	2902.44	UV	2906.73	3	Ni I	74	2905.746	UV
		Fe II	278	2902.459	UV	2907.11	1	Fe II	435	2905.770	UV
2902.61	3					2907.23	3d	Vd II	11	2906.448	UV
2902.66	2					2907.48	6D	Fe I?		2906.62	51
2902.90	2H	Mn II	50	2902.901	19	2907.45	6	Vd II	11	2906.448	UV
		Mg I	4	2902.923	44	2907.60	4	Fe I?		2906.62	51
2903.08	5	Vd II	11	2903.068	UV	2907.73	3	Fe I	150	2906.741	29
2903.20	2	Co I	130	2903.197	UV	2907.77	1				
2903.65	1	Ni I?		2903.653	UV	2907.85	4	Mn I	20	2907.214	UV
	1	Vd I	4	2903.700	UV	2907.95	6D	OH	(1-0)	2907.250	8
2903.77	2					2908.48	10	Vd II	10	2907.457	UV
2903.95	3	Cr II	97	2903.97	UV	2908.52	2	Ni I	2	2907.457	UV
2904.08	3	Fe I	167	2904.087	7	2908.57	167	Fe I	167	2907.517	7
2904.16	5	Fe I		2904.160	7	2908.65	4	Fe II	60	2907.853	UV

The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2907.94	3	OH	(2-1)	2907.950	8	2911.58	3	Fe II		2911.579	10
2908.00	3	Mn I OH	5 (1-0)	2907.993 2908.028	UV 8	2911.67	4	Cr II	212	2911.69	UV
2908.19	4					2911.90	2	Mo II	4	2911.915	UV
2908.28	3	Cr II	97	2908.29	UV	2912.07	3	Ti I	23	2912.082	58
2908.42	2h	Vd II	154	2908.44	UV	2912.15	7W	Fe I	1	2912.157	7
2908.48		OH	(2-1)	2908.496	8	2912.26	4	Fe I	86	2912.257	7
2908.71	1	Fe I?		2908.700	43	2912.50	1h				
2908.81	6W	Vd II	12	2908.810	UV	2913.07	4	Ti II	1	2913.08	UV
2909.04	4	Cr I	12	2909.049	UV	2913.20	2	Mg I		2913.205	38
2909.10	3	-Mo II	4	2909.108	UV	2913.44	2				
2909.31	3	Fe I	149	2909.316	7	2913.58	4	Ni II	26	2913.590	52
2909.49	4	Fe I		2909.499	7	2913.71	4w	-Cr I Cr I	87 87	2913.716	UV
2909.87	4					2913.99	4	Ni I	1	2914.006	UV
2909.91	4	Ti II	1	2909.912	UV	2914.19	4	Fe I	132	2914.197	7
2910.01	5	OH   Vd II	(1-0) 11	2910.002 2910.007	8 UV	2914.29	4	Fe I	89	2914.304	7
2910.09	3	OH	(1-0)	2910.094	8	2914.50	3				
2910.23	1					2914.58	5	Mn I	10	2914.599	UV
2910.38	5	Vd II	11	2910.380	UV	2914.73	2				
2910.64	4	Cr II	211	2910.64	UV	2914.85	2	Au I	6	2914.84	UV
2910.74	3	Fe II	435	2910.724	UV	2914.91	2	Vd I	5	2914.924	UV
		Fe II	278	2910.761	UV	2915.22	3h	Cr II	227	2915.22	UV
2910.90	5	Cr I	12	2910.892	UV	2915.45	6W	Mg I	15	2915.453	44
		Fe I	168	2910.926	7	2915.63	3h	Fe I		2915.658	29
2911.06	5	Vd II	10	2911.050	UV	2915.79	2				
2911.12	4	Cr I	12	2911.148	UV	2915.98	3	Zr II	9	2915.98	UV
2911.22	2										

## The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2916.14	5	Fe II Cr I	60 13	2916.150 2916.16	UV UV	2919.84	4	Fe I	142	2919.840	7
2916.20	5	-OH?	(1-0)	2916.237	8	2919.99	5	Vd II	11	2919.989	UV
2916.52	3	Fe I	117	2916.522	43	2920.13	3d				
2916.62	2	Zr II	9	2916.63	UV	2920.30	3	Fe I	136	2920.29	UV
2916.82	2					2920.37	5	Vd II	10	2920.377	UV
								Vd II	11	2920.377	UV
2916.91	3	OH Fe II	(2-1) 229	2916.922 2916.933	UV	2920.62	3	Fe I		2920.616	43
2917.08	3	Fe II	336	2917.087	UV	2920.68	5	Fe I	87	2920.690	7
2917.19	2	OH	(1-0)	2917.185	8	2920.98	5	Fe?		2920.981	7
2917.36	4	Vd II	11	2917.365	UV	2921.15	3				
2917.47	5	Fe II	61	2917.465	UV	2921.22	4	Cr II	286	2921.23	UV
2917.64	3h					2921.35	1	Cr I?	98	2921.35	UV
2917.87	4	Fe II?		2917.876	10	2921.59	3	Fe I	121	2921.600	43
2918.02	5	Fe I	182	2918.023	UV	2921.72	4	Fe I		2921.708	43
2918.16	4					2921.78	5	Cr II	95	2921.81	UV
2918.25	2	Cr I	13	2918.24	UV	2922.02	4	Fe II	293	2922.023	UV
2918.34	4	Fe I	134	2918.352	7	2922.15	3	OH	(2-1)	2922.104	8
2918.56	1	Fe II Fe I	435	2918.541 2918.563	UV 43	2922.21	4	Fe?		2922.211	7
2918.65	3	Ce II		2918.663	6	2922.38	4	Fe I	86	2922.383	UV
2918.80	4	OH Fe I	(2-1)	2918.789 2918.816	8 7	2922.53	1				
2918.90	3	OH	(1-0)	2918.919	8	2922.62	4	Fe I	122	2922.623	7
2919.01	4	Fe I?		2919.039	51	2922.82	1				
2919.19	5	OH?— OH?	(2-1) (1-0)	2919.168 2919.209	8 8	2923.06	1				
2919.57	2W	Co I— Hf II	134 8	2919.552 2919.60	UV 5	2923.16	4	Fe?		2923.164	7
						2923.42	5D	Fe I	286	2923.430	7
								Cr II		2923.46	UV

The Echelle Solar Spectrum (Continued)

Solar			Laboratory				Solar			Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref		
2923.62	3	Vd I	5	2923.627	UV	2926.98	2	Zr II	61	2926.99	UV		
2923.67	3	Cr II	286	2923.67	UV	2927.08	3	Cr II	256	2927.09	UV		
2923.84	5	Fe I	166	2923.853	7	2927.23	1h	Mn II	50	2927.230	19		
2924.01	6D	Fe I   Vd II	166 10	2924.002 2924.017	29 UV	2927.40	2	Mn II	50	2927.395	19		
2924.34	4	Fe I		2924.344	43	2927.57	4	Fe I		2927.55	UV		
2924.48	3	Fe I	86	2924.483	43	2927.65	1	Co I	136	2927.667	UV		
2924.54	2					2927.81	1	Nb II	15	2927.804	UV		
2924.64	6	Vd II	10	2924.633	UV	2927.88	3	Fe I OH	(2-1)	2927.884 2927.887	51 8		
2924.80	3	Ir I	1	2924.792	UV	2928.10	5	Cr II	55	2928.12	UV		
2924.94	1	Fe I?	183	2924.910	43	2928.19	3						
2925.08	4h	OH?—	(2-1)	2925.062	8	2928.29	4	OH	(1-0)	2928.288	8		
2925.30	2	Vd II	81	2925.288	UV			Ti I	34	2928.313	58		
2925.35	4	Fe I	167	2925.358	7			Cr II	95	2928.32	UV		
2925.52	4					2928.62	6	Cr II	256	2928.32	UV		
2925.60	4w	Mn I	10	2925.58	UV	2928.76	4	Mg II	2	2928.634	46		
2925.70	3	Fe I		2925.715	43	2929.02	6w	Fe I	1	2928.751	7		
2925.78	4	Fe		2925.785	7	2929.12	5	Fe I	182	2929.007	7		
2925.89	4	Fe I	89	2925.900	7	2929.23	4	Fe		2929.109	7		
2926.01	3	Fe I		2926.014	43	2929.28	3			2929.239	7		
2926.15	3	Cr II	95	2926.15	UV	2929.43	3	Cr II	239	2929.44	UV		
2926.24	3	Vd I	4	2926.258	UV	2929.49	3	Co I?	129	2929.505	UV		
2926.44	3	Vd II?	177	2926.442	UV	2929.61	4	Fe I	87	2929.618	UV		
2926.60	6W	Fe II	60	2926.584	UV	2929.78	2	Pt I	1	2929.79	UV		
2926.76	3	Ti II	27	2926.75	UV	2930.11	2	Vd II	81	2930.132	UV		
2926.90	3	OH	(1-0)	2926.894	8	2930.22	1	Mn I	3	2930.245	UV		
		OH	(2-1)	2926.894	8	2930.38	2	Fe I		2930.395	29		

The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2930.52	1	Fe II?		2930.489	10	2934.39	5	Fe I Vd II	117 10	2934.371 2934.394	7 UV
2930.64	3					2934.49	3	Fe II	278	2934.488	UV
2930.81	5	Vd II Cr II	10 55	2930.798 2930.83	UV UV	2934.60	3	Fe I Zr II	9	2934.598 2934.62	29 UV
2930.90	3	Ni I	78	2930.908	UV	2934.72	2	Mn II	50	2934.723	19
2931.00	2					2934.93	1				
2931.10	2					2935.13	4	Cr II	55	2935.12	UV
2931.26	1	Ti II	30	2931.261	56	2935.23	2				
2931.43	4w	Fe I OH	148 (2-1)	2931.412 2931.440	7 8	2935.33	1	Mn II	50	2935.355	19
2931.62	3	Fe I	117	2931.622	43	2935.54	2	Cr I? OH	(1-0)	2935.534 2935.548	28 8
2931.80	4	Fe I	166	2931.805	7	2935.65	2	Mn I	18	2935.643	4
2931.85	2	Sr I	1	2931.830	UV	2935.86	2	Vd I	3	2935.880	UV
2931.98	3					2936.06	6D	Fe II- Fe I	323 89	2936.022 2936.116	UV
2932.32	2h	Vd II?	166	2932.323	UV	2936.33	3	Zr II	11	2936.31	UV
2932.54	1	Ti I		2932.522	58	2936.51	7W	Mg II	2	2936.509	46
2932.60	2	Ni I		2932.618	48	2936.74	5	Mg I	3	2936.739	44
2932.69	3	Cr II	95	2932.69	UV	2936.91	8W	Fe I	1	2936.903	7
2932.87	2h					2937.18	2	OH?	(1-0)	2937.199	8
2933.04	6w	Mn II	5	2933.054	19	2937.29	3	Ti I	1	2937.293	58
2933.53	4	Ti I	1	2933.526	UV	2937.46	3				
2933.81	4	Mn II- Vd II	50 81	2933.779 2933.833	UV	2937.56	1				
2933.96	4	Cr II	95	2933.95	UV	2937.81	5	Hf II II Fe I	7 122	2937.782 2937.807	5 7
2934.00	2	Mn I	17	2934.020	4	2937.92	1	Mn I		2937.916	UV
2934.13	1	OH	(2-1)	2934.135	8	2938.04	3	Cr I?	73	2938.03	UV
2934.33	3	Cr II	211	2934.30	UV						

The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2938.12	1	OH	(1-0)	2938.128	8	2941.99	5w	Cr II	294	2941.96	UV
2938.24	1	Vd II	81	2938.259	UV			l Ti I	1	2941.963	58
2938.31	2	OH	(2-1)	2938.327	8	2942.18	3	l Ti II	26	2941.993	UV
2938.47	5	Mg I	3	2938.473	44	2942.37	2	l Mg I	3	2941.995	44
2938.72	3	Ti II	26	2938.69	UV			Fe II		2942.186	10
		Fe I	117	2938.722	43			Vd I	1	2942.354	UV
								Vd I	3	2942.354	UV
2939.08	5	Fe I	118	2939.071	7	2942.62	4	Fe I		2942.630	51
		Fe I	182	2939.071	7	2942.73	2	Ni II	25	2942.71	UV
2939.30	7w	Mn II	5	2939.312	19	2942.99	4				
2939.50	5	Fe II	60	2939.506	UV	2943.13	4	Ti II	30	2943.12	UV
								Mn II	82	2943.139	19
2939.90	3	Mn I	17	2939.904	4	2943.19	2	Vd I	1	2943.197	UV
2940.09	1	Fe II?	441	2940.114	7	2943.30	3	Fe I		2943.304	43
2940.23	2	Cr II	294	2940.22	UV	2943.57	4	Fe?		2943.574	7
2940.34	4	Mn I	10	2940.331	UV	2943.64	4	Ga I	1	2943.636	21
2940.47	3	Fe II		2940.467	10	2943.91	6	Ni I	24	2943.912	UV
2940.54	2					2944.18	1	Ga I	1	2944.173	21
2940.59	5	Fe I	173	2940.589	7	2944.40	6w	Fe II	78	2944.399	UV
2940.90	2	Fe II?		2940.889	23	2944.56	6	Vd II	10	2944.568	UV
		OH	(2-1)	2940.907	8						
2941.02	4h	Mn I	17	2941.038	4	2945.06	5	Fe I		2945.052	7
2941.26	5h	Fe I		2941.233	43	2945.25	5	Fe II	60	2945.262	UV
2941.37	6d	Fe I	1	2941.343	UV	2945.45	3	Ti II	26	2945.47	UV
		Vd II	10	2941.372	UV	2945.68	4	Fe I		2945.702	29
2941.49	5	Vd II	10	2941.485	UV	2945.86	3	Fe I		2945.870	29
2941.73	3					2946.08	2	Fe II		2945.884	10
2941.86	2	Cr I	5	2941.874	UV	2946.53	1	Fe I		2946.095	29
						2946.65	1	Vd I	1	2946.54	UV

The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2946.72	2					2951.16	3	Mn II	82	2951.168	19
2946.83	4	Cr II	192	2946.81	UV	2951.35	4	Fe I		2951.356	29
2946.96	1	W I	5	2946.989	UV	2951.55	3	Fe I?		2951.56	51
2947.11	4	Fe I	182	2947.116	29	2951.75	1				
2947.26	3	Fe I	86	2947.251	43	2951.88	1				
2947.36	5	Fe I	131	2947.363	UV	2951.97	1	Cr II	177	2951.94	UV
2947.45	3	Ni II?	35	2947.454	52	2952.07	5	Vd II	10	2952.07	UV
2947.66	6w	Fe II	78	2947.658	UV	2952.24	3w	Zr II—	1	2952.23	UV
2947.89	8W	Fe I	1	2947.876	7	2952.43	1				
2948.10	3	Vd II	196	2948.076	UV	2952.56	1	Fe I		2952.57	51
2948.24	5	Ti I	1	2948.238	58	2952.64	1				
2948.44	5	Fe I	166	2948.433	UV	2952.87	1w	Mn II	49	2952.871	19
2948.73	4	Fe I	118	2948.727	7	2953.06	1				
2948.97	5	Fe I	117	2948.952	7	2953.36	3	Cr II	55	2953.34	UV
2949.21	8w	Fe II Mn II	277 5	2949.178 2949.204	UV 19	2953.51	5	Fe I	166	2953.486	UV
2949.45	3	Cr II	178	2949.44	UV	2953.69	4	Cr II	192	2953.70	UV
2949.68	4	Fe I	117	2949.688	29	2953.77	6	Fe II	60	2953.774	UV
2949.79	2	Cr II?	210	2949.79	UV	2953.93	8W	Fe I	1	2953.940	UV
2950.13	1	Cr II Cr II	65 178	2950.10 2950.10	UV UV	2954.33	3	Vd I	1	2954.33	UV
2950.25	5w	Fe I	120	2950.243	7	2954.65	5	Fe I	132	2954.652	7
2950.33	5	Vd II	10	2950.344	UV	2954.81	1				
2950.69	1	Cr II?	65	2950.69	UV	2954.95	4	Fe I		2954.957	29
2950.83	1					2955.14	4	Cr II Mn II	177 49	2955.12 2955.141	UV 19
2950.88	3	Nb II	14	2950.876	UV	2955.39	1	Mn II Co I	49 19	2955.379 2955.382	UV
2951.10	3	Fe II	214	2951.095	UV						

The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2955.50	1	Gd III		2955.534	3	2958.94	2	Mn II	49	2958.942	19
2955.62	3	Fe I		2955.619	29	2959.00	1	Mn II	49	2958.942	19
2955.68	1					2959.24	1	Ti II?	34	2958.996	56
2955.79	4	Zr II		2955.77	UV	2959.31	5	OH	(1-0)	2959.246	8
		Fe I	61	2955.777	43	2959.59	5	Fe II	254	2959.329	7
2955.93	3	Ce II?		2955.941	6	2959.67	5	Fe I	172	2959.601	UV
2956.13	5	Ti I	1	2956.118	58	2959.82	2	Fe II	403	2959.841	23
2956.33	4	Cr I	5	2956.328	UV	2959.94		Fe II	439	2959.841	UV
2956.60	4	Cr II-	176	2956.60	UV	2959.99		Cr II	177	2959.95	UV
2956.70	5	Fe I	118	2956.704	7	2960.07		Fe I	[316]	2959.991	7
2956.79	4	Ti I	1	2956.795	58	2960.29	5	Fe I	134	2960.296	7
2956.84	4	Fe I	165	2956.858	7	2960.49	3				
2956.98	2	Mn II	49	2956.977	19	2960.54	5	Fe I		2960.554	7
2957.22	2					2960.66	4	Fe I	178	2960.660	7
2957.36	7W	Fe I	1	2957.364	7	2960.76	3				
2957.49	6	Fe I	132	2957.486	7	2961.08	3				
		Vd II	10	2957.520	UV	2961.17	3	Cu I	15	2961.165	UV
2957.63	4					2961.28	5	Fe II	60	2961.272	UV
2957.86	1	Fe I?		2957.868	43	2961.36	3	Fe I		2961.346	43
2958.06	1w					2961.45	3	Ti I	28	2961.442	58
2958.18	1					2961.56	2				
2958.28	3	Ni I	74	2958.283	UV	2961.72	4	Mn II	49	2961.689	19
2958.41	3					2961.70		Cr II	55	2961.70	UV
2958.52	1	Fe II	398	2958.528	UV	2961.72		Cr II	177	2961.72	UV
2958.69	2	Mn II	50	2958.715	19	2961.90	1				
2958.77	2	Ti I		2958.770	58	2962.12	4	Fe I	[57]	2962.108	7

The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2962.16	2					2966.05	5	Cr II	94	2966.03	UV
2962.29	1					2966.20	5	Fe I		2966.193	43
2962.40	4					2966.26	5	Fe I	118	2966.264	7
2962.56	3	Fe I		2962.585	29	2966.91	9w	Fe I	1	2966.898	7
2962.66	3	Zr II	9	2962.69	UV	2967.22	5d	[C I Ti I]	1	2967.214	37
2962.77	2	Vd I	1	2962.784	UV	2967.53	1			2967.218	58
2963.07	2					2967.64	5	Cr I	11	2967.64	UV
2963.27	1	Mn I?	4	2963.250	UV	2968.07	3	-OH	(1-0)	2968.073	8
2963.48	2	Cr II	176	2963.46	UV	2968.22	2w	Ti I	[29]	2968.226	58
2963.54	4	Fe I		2963.518	29	2968.37	5w	Vd II	[28]	2968.373	MT
2963.62	3	Mn I-	3	2963.606	UV	2968.48	5	Fe I	135	2968.477	7
2963.67	4	-Fe I	173	2963.700	43	2968.55	2				
2963.81	2	Fe I	[316]	2963.829	43	2968.69	4	Cr II	176	2968.68	UV
2964.03	2					2968.73		Fe II	253	2968.738	UV
2964.12	4	Fe II	252	2964.131	UV	2968.96	3	Zr II	10	2968.95	UV
2964.20	4	Fe I		2964.196	29	2969.07	2	Fe I?		2969.09	51
2964.50	3	Fe I?		2964.489	43	2969.18	4	Ni I	74	2969.190	UV
2964.64	6d	Fe II-	78	2964.629	UV	2969.36	6	Fe I	[11]	2969.360	7
2964.85	4h	C I	1	2964.840	37	2969.48	6	Fe I	[30]	2969.474	7
2965.04	6	Fe II	78	2965.036	UV	2969.63	3	Fe II		2969.623	10
2965.26	7	Fe I	1	2965.254	7			Zr II	9	2969.63	UV
2965.39	4	Fe II	251	2965.395	UV	2969.94	5	Fe II	277	2969.934	UV
2965.51	1					2970.12	8	Fe I	1	2970.100	7
2965.72	3	Ti I	27	2965.686	58			Fe I	[11]	2970.118	7
2965.81	5	Fe I	147	2965.806	7	2970.35	5d	Si I Ti I	[1] [29]	2970.355	37
2965.88	4					2970.52	6	Fe II	60	2970.510	58

The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2970.68	4	Fe II	276	2970.682	UV	2975.48	5	Cr I	11	2975.478	UV
2970.90	3					2975.66	4h	Vd II Fe I	[28]	2975.650 2975.655	MT 29
2970.95	2	Fe II		2970.947	10	2975.85	3				
2971.11	5	Cr I	11	2971.102	UV	2975.93	5	Fe II	60	2975.938	UV
2971.24	2					2976.14	5	Fe I	131	2976.128	7
2971.50	1					2976.19	4	Vd II	[28]	2976.197	MT
2971.60	2	Fe II	252	2971.616	UV	2976.38	1				
2971.75	3	Fe I		2971.776	29	2976.54	6	Vd II	[28]	2976.517	MT
2971.91	5	Cr II	80	2971.90	UV	2976.72	4	Cr II	55	2976.70	UV
2972.01	3	—Fe II	398	2972.016	UV	2976.90	4	Fe I	172	2976.909	7
2972.28	5	Vd II Fe I	[87] 118	2972.263 2972.280	MT 7	2977.23	1				
2972.42	3					2977.54	3	Vd I	1	2977.550	UV
2972.58	1					2977.66	2				
2973.13	7W	Fe I	1	2973.132	7	2977.81	1	Ti II?		2977.80	UV
2973.23	8W	Fe I	1	2973.235	7	2978.05	4	Fe I Zr II	10	2978.060 2978.07	29 UV
2973.72	4h	Ni I	66	2973.730	UV	2978.19	2				
2973.91	3					2978.27	2				
2974.10	2	Mn I	41	2974.089	UV	2978.46	3				
2974.21	3					2978.56	3	—Mn I	3	2978.566	UV
2974.35	2h					2978.67	3				
2974.64	3					2978.85	3	Fe II	276	2978.850	UV
2974.78	4	Fe I	[335]	2974.780	7	2979.09	3	Fe II	306	2979.096	23
2974.91	1	Ti I	27	2974.926	58			Fe II	403	2979.096	23
2975.02	3					2979.17	3	Zr II	10	2979.18	UV
2975.31	3	Fe I		2975.298	29	2979.36	6	Fe II	60	2979.349	UV

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2979.50	1					2983.00	2	Vd II?	60	2983.009	UV
2979.61	2	OH	(3-2)	2979.615	8	2983.15	2	Vd II?	[28]	2983.009	MT
2979.74	5	Cr II	80	2979.741	UV	2983.31	4	Ti I	[29]	2983.290	58
2979.87	3	Fe I		2979.867	29	2983.44	4	Ni I	66	2983.426	UV
2979.94	2	OH	(1-0)	2979.929	8	2983.59	8W	Fe I	[9]	2983.570	7
2980.00	2					2984.13	5	Ni I	[12]	2984.131	MT
2980.21	3					2984.36	3	OH	(3-2)	2984.371	8
2980.41	2h	Ce II?		2980.410	6	2984.57	5	Fe		2984.559	7
2980.53	5	Fe I	[317]	2980.534	7	2984.83	7W	Fe I	[29]	2984.767	7
2980.57	4	Fe I	147	2980.592	43	2984.83	7W	Fe II	78	2984.831	UV
2980.79	5	Cr I	11	2980.784	UV	2985.16	1	Vd II	[218]	2985.184	MT
2980.96	4	Fe II	253	2980.963	UV	2985.33	5	II Cr II	80	2985.325	UV
2981.02	3	Zr II	[24]	2981.02	MT	2985.56	6	Zr I	1	2985.36	UV
2981.21	3w	Vd II	[87]	2981.200	MT	2985.72	4	Fe II	78	2985.545	UV
2981.30	3	Ti II?		2981.27	38	2985.86	5	Fe I		2985.750	29
2981.44	7	Fe I	[11]	2981.445	7	2985.99	5	Cr I	11	2985.849	UV
2981.65	7	Ni I	24	2981.645	UV	2986.13	4	Cr I	11	2986.01	UV
2981.85	5	Fe I	118	2981.852	UV	2986.30	3w	Cr I	11	2986.13	UV
2981.96	3					2986.46	5	Fe I		2986.313	51
2982.04	4	Fe II	335	2982.059	UV	2986.46	5	Cr I	[11]	2986.456	7
2982.25	4	Fe I	178	2982.229	7	2986.63	5	Fe II	11	2986.466	UV
		Fe II	277	2982.239	UV	2987.04	3				
2982.39	3	-OH	(1-0)	2982.403	8	2987.18	5	Fe II	254	2986.617	UV
2982.48	3					2987.30	6w	Co I	[11]	2987.166	MT
2982.63	2					2987.54	2	Fe II	[30]	2987.290	7
2982.76	3	Vd II	[28]	2982.75	MT	2987.65	7W	Fe II	437	2987.542	UV
						Si I		Si I	[1]	2987.645	37

## The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2987.96	1					2992.42	5	Cr II-	80	2992.42	UV
2988.04	4	IVd II Cr II	[27] 80	2988.027 2988.04	MT UV	2992.59	6	Ni I	[25]	2992.595	MT
2988.18	2	Fe I	[335]	2988.186	43	2993.03	2h				
2988.46	4	Fe I	[56]	2988.472	7	2993.22	2	Fe?		2993.181	7
2988.64	5	Cr I	4	2988.638	UV	2993.29	2				
2988.77	3					2993.40	3h	Fe II	335	2993.366	UV
2988.92	4D	Fe I Sc I Sc II	[11] [34]	2988.882 2988.952 2988.952	7 MT MT	2993.79	4	Fe		2993.793	7
2989.19	5	Cr II	80	2989.18	UV	2994.06	4	Cr I	4	2994.06	UV
2989.39	1	Fe I	85	2989.392	43	2994.18	3				
2989.60	5	Co I Vd II	[13] [28]	2989.590 2989.594	MT MT	2994.43	8W	Fe I	[9]	2994.427	7
2989.70	3	OH	(3-2)	2989.688	8	2994.50	7W	Ni I	[27]	2994.460	MT
2990.03	1					2994.75	3	Fe I	[11]	2994.502	7
2990.36	6	Fe I	[316]	2990.391	7	2994.94	5	Cr II	80	2994.74	UV
2990.86	3	Ce II	[72]	2990.872	6	2995.10	4	Ca I	[17]	2994.958	45
2991.09	5	Ni I	1	2991.106	UV	2995.24	3	Cr I	3	2995.094	UV
2991.09	5	Ni I	75	2991.106	UV	2995.37	2				
2991.23	2h	Fe II	252	2991.244	UV	2995.49	3	Fe I			
2991.39	2h	Zr II	[6]	2991.40	MT	2995.57	2	OH	[506] (3-2)	2995.565 2995.573	43 8
2991.63	6	Fe I		2991.632	7	2995.84	3	Fe I	178	2995.838	UV
2991.77	4	Fe		2991.762	7	2996.00	3w	Vd II	[27]	2995.999	MT
2991.88	5	Cr I	11	2991.877	UV	2996.06	2				
2992.08	2h					2996.39	4	Fe I	134	2996.385	7
2992.17	1h					2996.58	4	Cr I	11	2996.571	UV
2992.36	2	OH	(1-0)	2992.349	8	2996.72	1	Vd II?	[28]	2996.70	MT
						2996.84	2h				

## The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
2997.22	3	Fe II		2997.216	7	3000.93	8W	Fe I	[9]	3000.948	7
2997.31	4	Fe II Ca I	335 [17]	2997.298 2997.314	UV 45	3001.22	5	Vd II	[27]	3001.203	MT
2997.52	1	Fe I		2997.538	43	3001.42	1	Fe II?		3001.454	10
2997.73	1	Fe II	292	2997.749	UV	3001.66	2	Fe I	[506]	3001.655	7
2997.86	1					3001.77	2h	Vd II	[141]	3001.754	MT
2997.97	2	Pt I	3	2997.97	UV	3001.92	2	Fe I	178	3001.924	43
2998.01	1	OH	(3-2)	2998.018	8	3002.02	1h	OH	(3-2)	3002.029	8
2998.15	3					3002.20	2d	OH? Fe II	(3-2)	3002.183 3002.200	8 10
2998.34	2h	Fe I		2998.332	43	3002.33	3	Fe II	[98]	3002.330	MT
2998.50	2	Fe II		2998.487	10	3002.41	1	Fe I		3002.439	43
2998.79	4	Cr I	4	2998.783	UV	3002.48	6W	Ni I	24	3002.484	UV
2998.85	3	Fe II	252	2998.855	UV	3002.61	2	-Mn I	3	3002.616	UV
2998.93	4	Fe II?	437	2998.911	38	3002.66	5H	Fe II	78	3002.650	UV
2999.00	3	OH-	(3-2)	2998.990	8	3003.03	5	Fe I	[30]	3003.030	7
2999.04	3	Gd II	[12]	2999.045	MT	3003.48	3w	Vd II	[27]	3003.461	MT
2999.20	4	Fe I		2999.191	7	3003.62	6	Ni I	24	3003.622	UV
2999.32	3	Cr II-	94	2999.30	UV	3003.86	3d	Fe?		3003.863	7
2999.38	3					3003.89		Fe II Cr II	94	3003.907 3003.92	10 UV
2999.52	7W	Fe I	[30]	2999.512	7	3004.11	4	Fe I	[199]	3004.116	7
2999.64	3	Ca I	[17]	2999.641	45	3004.26	2	Fe II	276	3004.249	UV
2999.94	2h	Cr II	137	2999.96	UV	3004.31	1				
3000.06	3	Fe II	276	3000.059	UV	3004.63	4	Fe I	[57]	3004.630	7
3000.34	3					3005.05	5	Cr I	11	3005.06	UV
3000.46	4	Fe I	[56]	3000.451	7	3005.30	5	Fe I	[199]	3005.305	7
3000.56	3d	Co I	[13]	3000.545	MT						

## The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
3005.47	1	OH Zr I	(3-2) [60]	3005.474 3005.50	8 MT	3009.20	4	Ca I	[17]	3009.205	45
3005.72	3					3009.36	2	OH?	(3-2)	3009.358	8
3005.76	2	Co I	[77]	3005.766	MT	3009.56	6W	Fe I	[30]	3009.569	7
3005.97	3	Fe I?		3005.951	51	3009.89	1			3010.015	51
3006.17	1h	OH	(3-2)	3006.183	8	3010.01	1	Fe I?			
3006.31	2h	Fe I?		3006.330	51	3010.19	4	Fe II	[181]	3010.220	MT
3006.43	2	Fe		3006.448	7	3010.42	1	Ti I?	[170]	3010.42	MT
3006.54	4	Fe		3006.543	7	3010.62	2d	-Cr II		3010.64	27
3006.60	3	Fe I		3006.598	29	3010.84	1	Cu I	14	3010.838	UV
3006.74	4	Si I	0.01	3006.739	37	3011.16	2	Mn I	[35]	3011.165	4
3006.86	4w	Ca I	[17]	3006.863	45	3011.28	2				
3007.15	6	Fe I	[55]	3007.145	7	3011.37	2	Mn I	[35]	3011.376	4
3007.28	6d	II Fe I Vd II	[11] [27]	3007.282 3007.296	7 MT	3011.48	5	Fe I	[316]	3011.482	MT
3007.47	2h	Ti I		3007.487	MT	3011.72	3	Zr I	1	3011.73	UV
3007.65	2	Mn I	[35]	3007.650	4	3011.83	1				
3007.73	1	Fe I	[262]	3007.75	MT	3011.88	4	Fe I	135	3011.883	29
3007.79	1					3012.00	6W	Ni I	[41]	3012.004	MT
3008.13	7W	Fe I	[9]	3008.139	7	3012.43	5	Fe I		3012.443	7
3008.24	2	Mn I	[35]	3008.258	4	3012.93	4	Fe I		3012.942	29
3008.31	2	Ti II	[85]	3008.322	MT	3013.02	4	Cr I	[26]	3013.033	28
3008.44	3d					3013.08	4w	Vd II	[26]	3013.102	MT
3008.61	3	Vd II	[26]	3008.610	MT	3013.32	1	Zr II	[27]	3013.32	MT
3008.65	3					3013.49	3	Fe I?		3013.515	43
3008.79	2	Ce II	[122]	3008.785	6	3013.59	4	Co I	[10]	3013.592	MT
3009.09	5	Fe I	[198]	3009.093	7	3013.71	5w	Cr I	[26]	3013.72	28

## The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
3014.11	3	Fe I	[458]	3014.106	7	3017.84	3	Fe		3017.856	7
3014.16	4	Fe I	[31]	3014.173	7	3017.94	1	Ni I	74	3017.947	UV
3014.31	2	Fe I		3014.314	43	3018.13	3	Fe I	[199]	3018.136	7
3014.45	1h	Zr I?	[21]	3014.44	MT	3018.24	2	Fe I	[263]	3018.25	MT
3014.65	1	Mn I	[35]	3014.666	4	3018.36	1	Zn I	[5]	3018.352	MT
3014.76	5	Cr I	[27]	3014.756	28	3018.50	5	Cr I	[26]	3018.492	28
3014.83	4	Vd II	[27]	3014.822	MT	3018.81	5	Cr I	[26]	3018.827	28
3014.92	5	Cr I	[27]	3014.932	28	3018.98	6	Fe I	[30]	3018.983	7
3015.18	5	Cr I	[27]	3015.197	28	3019.14	6	Ni I	[11]	3019.143	MT
3015.35	1	Sc I	[10]	3015.364	MT	3019.28	4	Fe I	[199]	3019.290	7
3015.49	3	Cr II	[87]	3015.510	MT	3019.81	1	Fe		3019.804	7
3015.68	1h	Co I	[76]	3015.686	MT	3019.91	3	Mn II		3019.923	19
3015.81	1					3020.00	4	Fe II	[110]	3020.001	MT
3015.92	5	Fe I	[198]	3015.920	7	3020.49	8W	Si I	0.01	3020.004	37
3015.98	1					3020.63	9W	Fe I	[9]	3020.491	7
3016.19	6	Fe I	[30]	3016.182	7	3021.07	8W	Fe I	[9]	3020.639	7
3016.45	2	Mn I	[35]	3016.454	4	3021.55	6	Cr I	[27]	3021.576	28
3016.53	1					3022.25	2	Fe I		3022.260	43
3016.77	4w	Vd II	[27]	3016.775	MT	3022.34	2	Fe		3022.330	7
3016.85	2					3022.58	3w	Vd II	[26]	3022.57	MT
3017.19	4	Ti II	[85]	3017.187	MT	3022.73	3	Mn I	[35]	3022.743	4
		Ce II	[107]	3017.195	6						
3017.26	4	Co I	[78]	3017.254	MT	3023.06	3				
		Fe		3017.259	7	3023.68	1				
3017.41	4	Fe		3017.418	7	3023.85	2W	Fe II	[84]	3023.859	MT
3017.60	7W	Co I	[11]	3017.548	MT			Vd II	[41]	3023.882	MT
		Cr I	[27]	3017.591	28						
		Fe I	[9]	3017.627	7	3024.03	7W	Fe I	[11]	3024.032	7

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
3024.22	2					3029.10	3				
3024.34	6	Cr I	[26]	3024.359	28	3029.18	5	Cr I	[26]	3029.165	28
3024.68	1	Cr I	[117]	3024.689	28	3029.26	5w	Fe I	[56]	3029.234	7
3024.80	3	Fe		3024.798	7	3029.30	3	Ni I	[56]	3029.293	MT
								Ni I	74	3029.293	UV
3024.98	3w	Vd II	[85]	3024.981	MT	3029.54	1h	Zr I	1	3029.52	UV
3025.28	4	Fe I	[29]	3025.280	7	3029.74	5	Ti II	[85]	3029.730	MT
3025.64	6	Fe I	[198]	3025.638	7	3029.99	3				
3025.86	8W	Fe I	[9]	3025.842	7	3030.16	6	Fe I	[198]	3030.148	7
3026.37	3	Co I	[77]	3026.373	MT	3030.25	6	Cr I	[27]	3030.25	28
3026.46	6W	Fe I	[30]	3026.461	7	3030.61	3	Fe I	[145]	3030.603	7
3026.64	4	Cr II	[95]	3026.64	27	3030.78	1	Sc I	[10]	3030.769	MT
								Fe I	[459]	3030.787	7
3026.83	2	Cr II	[41]	3026.86	27	3030.85	1	OH?	(3-2)	3030.842	8
3026.96	2					3030.94	3d	Zr II—Fe I	[6]	3030.91	MT
3027.00	2									3030.963	43
3027.02	2	Vd II	[85]	3027.600	MT	3031.04	3	Mn II		3031.038	19
		Gd II	[12]	3027.602	MT						
3027.66	2					3031.23	6	Fe I	[198]	3031.214	7
3027.72	2					3031.35	5	Cr I	[27]	3031.346	28
3028.05	4	Vd II	[85]	3028.042	MT	3031.49	2	Cr I	[117]	3031.498	28
		Zr II	[76]	3028.05	MT						
3028.13	4	Cr II	[87]	3028.12	27	3031.63	6	Fe I	[30]	3031.634	7
3028.28	1					3031.72	5	Fe?		3031.718	7
3028.62	2					3031.88	6	Ni I	[11]	3031.870	MT
3028.70	2	Fe		3028.700	7	3032.18	1	Ni II	[3]	3032.458	52
3028.88	3					3032.47	2				
3029.04	3	Mn II	[10]	3029.043	19	3032.86	1	Gd II	[12]	3032.845	MT
		Mn II		3029.043	19	3032.93	4	Cr II	[15]	3032.94	27

## The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
3033.10	4	Fe I	131	3033.100	7	3037.68	2				
3033.43	4w	Vd II	[123]	3033.445	MT	3037.77	4	Fe I	[31]	3037.779	7
		Fe II	[181]	3033.445	MT						
3033.59	2h	Mn II	[21]	3033.574	19	3037.92	6	Ni I	[25]	3037.935	MT
		Mn II		3033.574	19	3038.09	3	Mn II		3038.092	19
3033.81	4	Vd II	[34]	3033.821	MT	3038.30	4	Co I		3038.302	50
								Fe I		3038.314	7
3034.06	1	Gd II	[12]	3034.051	MT	3038.51	3	Mn II		3038.507	19
3034.19	5	Cr I	[26]	3034.191	28	3038.72	3	Ti II	[85]	3038.706	MT
3034.42	4	Co I	[12]	3034.432	MT	3038.77	3	Fe II	[84]	3038.777	MT
3034.48	5	Fe I	[57]	3034.484	7	3039.00	2				
3034.52	4	Cr II	94	3034.54	UV	3039.07	4	Ge I	[2]	3039.067	25
3034.81	1	Mn II	[21]	3034.807	19	3039.31	4	Fe I	[199]	3039.318	7
3034.98	2	Cr II	137	3034.99	UV	3039.56	1	Mn II	[10]	3039.550	19
3035.23	2	Fe I	[506]	3035.25	MT	3039.60	4w	Co I	[52]	3039.563	MT
3035.36	3	Mn II		3035.350	19						
3035.74	5	Fe I-		3035.737	7	3039.77	4	Cr I	[26]	3039.77	28
3035.89	1					3040.43	6	Fe I	[30]	3040.427	7
3036.12	2h	Cu I	17	3036.101	UV	3040.50	1				
3036.25	1					3040.59	4	Mn I	[34]	3040.600	4
3036.40	2	Zr II	[25]	3036.39	MT	3040.77	2				
3036.50	1	Zr II	[24]	3036.50	MT	3040.84	4	Cr I	[27]	3040.837	28
3036.77	2h	Ti II	[78]	3036.784	MT	3040.94	5	Cr II	[65]	3040.91	27
3036.98	2	Fe II	[181]	3036.986	MT	3041.02	2				
3037.06	5	Cr I	[27]	3037.049	28	3041.23	1	Mn I	[34]	3041.220	4
3037.22	3					3041.41	2h	Vd II	[40]	3041.42	MT
3037.40	8W	Fe I	[9]	3037.389	7	3041.51	1				
3037.54	3					3041.65	6	Fe I	[56]	3041.637	7

## The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
3041.74	6	Cr II  Fe I	[95] [30]	3041.73 3041.738	27 7	3045.79	2	Mn I	[34]	3045.804	4
3041.91	3					3046.04	2	Fe II?		3046.064	10
3042.02	6	Fe I	[30]	3042.019	7	3046.28	1	Mn II	[10]	3046.271	19
3042.26	3	Vd II	[40]	3042.27	MT	3046.49	2				
3042.50	4	Co I	[10]	3042.481	MT	3046.68	5	Ti II	[47]	3046.685	MT
3042.67	6	Fe I	[30]	3042.664	7	3046.81	3	Fe I	[315]	3046.819	MT
3042.73	3	Mn I	[34]	3042.734	4	3046.93	4	Fe I	[198]	3046.926	7
3042.84	4	Fe		3042.843	7	3047.04	4	Mn I	[34]	3047.032	4
3043.13	3	Vd I Mn II Mn I	[17] [21] [34]	3043.124 3043.128 3043.139	MT 19 4	3047.22	3	Fe I	[382a]	3047.201	MT
3043.35	3	Mn I	[34]	3043.355	4	3047.60	8W	Fe I	[9]	3047.604	7
3043.54	3	Vd II Vd I	[40] [17]	3043.54 3043.555	MT MT	3047.76	4	Cr II	[15]	3047.77	27
3043.78	1	Mn I	[34]	3043.768	4	3048.00	1				
3043.85	4	Ti II	[78]	3043.851	MT	3048.09	1	Co I	[77]	3048.108	MT
3044.00	5	Co I	[11]	3044.004	MT	3048.22	3	Vd II	[123]	3048.214	MT
3044.12	2					3048.36	1				
3044.23	2w	Cr II	[154]	3044.23	27	3048.45	5	Fe I		3048.452	7
3044.57	4	Mn I	[15]	3044.566	4	3048.76	3	Ti II	[78]	3048.766	MT
3044.84	3	Fe II	[98]	3044.843	MT	3048.89	4	Mn I	[34]	3048.860	4
3044.94	2	Vd I	[17]	3044.936	MT	3049.01	2h	Co I	[11]	3048.888	MT
3045.03	5	Ni I	[12]	3045.006	MT	3049.13	1h	Vd II	[40]	3048.891	MT
3045.09	5	Fe I	[29]	3045.078	7	3049.13	1h				
3045.58	4	Fe I	[198]	3045.587	7	3049.35	4	Fe I		3049.354	7
3045.72	3	Mn I	[34]	3045.590	4	3049.54	3	Fe I		3049.564	29
		Sc II	[37]	3045.714	MT	3050.08	3w	Al I	[7]	3050.073	14

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
3050.13	4	Cr II	[65]	3050.14	27	3054.84	3	Zr II	[76]	3054.84	MT
3050.24	1h					3054.94	3	Fe I	[263]	3054.949	MT
3050.40	1w	Vd I?	[74]	3050.400	MT	3055.13	3				
3050.50	1h	Co I	[77]	3050.496	MT	3055.22	3	Ce II	[201]	3055.238	6
3050.66	4	Mn II	[21]	3050.654	19	3055.27	5	Fe I	[55]	3055.262	7
3050.82	7W	Ni I	[25]	3050.819	MT	3055.34	3	Fe II	[181]	3055.368	MT
3050.93	4	Co I	[51]	3050.932	MT	3055.45	2h	Cr II	94	3055.44	UV
3051.03	3					3055.70	4	Fe I		3055.710	7
3051.43	2h	Mn II		3051.426	19	3056.10	2				
3052.13	1					3056.24	4	Fe I		3056.242	7
3052.21	1	Cr I	[164]	3052.218	28	3056.33	4	Vd I	[17]	3056.334	MT
3052.27	1	Fe I?		3052.264	43	3056.58	3				
3052.49	2					3056.74	5	Ti II	[47]	3056.740	MT
3052.59	1					3056.77	4	Ce II	[121]	3056.775	6
3052.79	1h	Fe I	[262]	3052.78	MT	3056.77		Fe II	[109]	3056.802	MT
3052.92	1	Sc II	[37]	3052.929	MT	3057.02	2				
3053.06	5	Fe I	131	3053.067	7	3057.16	4	Al I	[7]	3057.144	14
3053.42	5D	Vd II	[34]	3053.39	MT	3057.46	2W	Fe I	[28]	3057.446	7
		Fe I	[398]	3053.429	7	3057.65	7	Ni I	24	3057.638	UV
		Fe I	[31]	3053.455	7	3057.80	4	Fe I	[29]	3057.789	7
3053.67	3	Vd I	[17]	3053.65	MT	3057.87	1	Cr II	[65]	3057.86	27
		Cr II	[64]	3053.65	27	3057.87					
3053.76	3	Fe I		3053.781	29	3057.96	3				
3053.88	5	Cr I	[26]	3053.87	28	3058.08	5	Ti II	[47]	3058.090	MT
		Vd II	[40]	3053.894	MT	3058.36	4	Cr II?	[48]	3058.36	27
3054.33	6w	Cr II?	[25]	3054.316	MT	3058.50	4	Fe I		3058.493	7
		Mn I	[15]	3054.362	4	3058.71	3h				
3054.70	3h	Al I	[7]	3054.679	14	3058.71					
		Co I	[13]	3054.724	MT						

## The Echelle Solar Spectrum (Continued)

Solar			Laboratory			Solar			Laboratory		
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
3058.96	4					3062.69	1h	Vd II	[34]	3062.702	MT
3059.11	8W	Fe I	[9]	3059.086	7	3062.83	2				
3059.37	4	Cr II	[15]	3059.38	27	3062.87	4	Fe I	[456]	3062.872	MT
3059.51	5	Cr II	[15]	3059.53	27	3063.18	3w	Fe I	[102]	3063.149	MT
		Cr II	[15]	3059.53	27	3063.24	4	Vd II	[123]	3063.247	MT
3059.74	5	Ti II	[5]	3059.741	MT	3063.49	4	Ti II	[47]	3063.502	MT
		Ti II	[47]	3059.741	MT	3063.56	4	OH	(0-0)	3063.565	8
3059.94	1	Al I	[7]	3059.924	14	3063.73	5	OH	(0-0)	3063.725	8
3060.03	3w	Fe II	[109]	3060.023	MT	3063.79	1	Fe II		3063.814	23
		Co I	[77]	3060.048	MT	3063.93	5	II Fe I	[132]	3063.931	7
3060.25	1	Fe		3060.359	7	3064.19	5	Ni II	[3]	3063.942	52
3060.45	3	Vd I	[17]	3060.460	MT	3064.02	4	Fe		3064.018	7
3060.53	3	Fe I	[457]	3060.538	7	3064.23	4	OH	(0-0)	3064.189	8
3060.62	4	Fe		3060.621	7	3064.37	3	OH	(0-0)	3064.236	8
3060.77	4	Fe		3060.777	7	3064.62	6	Co I	[13]	3064.370	MT
3061.00	5	Fe I	[55]	3060.983	7	3064.68	4	Ni I	24	3064.619	UV
3061.14	1					3064.83	3	Pt I	1	3064.69	UV
3061.38	1h					3064.95	4	OH	(0-0)	3064.950	8
3061.57	2	Cr II	[41]	3061.58	27	3065.06	4w	Cr I	[184]	3065.065	28
3061.65	1	Cr I	[55]	3061.64	28			OH	(0-0)	3065.095	8
3061.82	5	Co I	[11]	3061.822	MT			Sc II	[37]	3065.106	MT
3061.98	1	Fe I?		3061.948	51	3065.32	4	Fe II	[97]	3065.315	MT
		Co I?	[52]	3061.983	MT	3065.62	1	Vd II	[112]	3065.61	MT
3062.12	3	Mn I	[15]	3062.120	4	3066.00	5	OH	(0-0)	3065.976	8
3062.24	5D	Co I	[12]	3062.199	MT			Mn I	[15]	3066.022	4
		Fe II	[108]	3062.234	MT	3066.15	4	Al I	[7]	3066.145	14
3062.50	1	Fe		3062.491	7	3066.23	6	Ti II	[5]	3066.220	MT

The Echelle Solar Spectrum (Continued)

Solar		Laboratory				Solar		Laboratory			
Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref	Wavelength Å	Int	Ident	Multiplet No	Wavelength Å	Ref
3066.35	6W	I Ti II Vd I	[5] [17]	3066.354 3066.375	MT MT	3067.93	5	OH OH Fe I	(0-0) (0-0) [315a]	3067.929 3067.929 3067.948	8 8 7
3066.49	6	Fe I Ti II	[313] [47]	3066.479 3066.514	7 MT	3068.18	5	Fe I	[55]	3068.173	7
3066.69	2	Fe I	[456]	3066.69	MT	3068.26	4	OH	(0-0)	3068.277	8
3066.82	2					3068.47	3				
3067.03	5	Fe I		3066.999	7	3068.61	4	OH	(0-0)	3068.608	8
3067.15	6w	Vd II Fe I Cr II Cr II	[34] [56] [15] [15]	3067.104 3067.118 3067.18 3067.18	MT 7 27 27	3068.72	4	OH	(0-0)	3068.704	8
3067.25	7W	Fe I	[28]	3067.244	7	3068.94	2	Fe II	[122]	3068.757	MT
3067.66	4	OH	(0-0)	3067.661	8	3069.18	4	OH	(0-0)	3069.177	8
3067.77	3	OH	(0-0)	3067.775	8	3069.34	3	Fe		3069.330	7
						3069.44	4	Fe I		3069.443	7

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